Vol. XVI, No. 4 MAY, 1946

THE TOOL ENGINEER

OFFICIAL PUBLICATION OF THE ASTE AMERICAN SOCIETY OF TOOL ENGINEERS

Editorial . . . . . *by A. M. Sargent*

Voluntary Economic Methods versus Compulsory Economic Systems . . . . . *by Erik Oberg*

Effect of Frequency on Induction Heating . . . . *by Dr. Russel A. Nielson*

The Tools and Techniques for the Production of Precision Gears—A Symposium—(Concluded)

The Grinding of Gears . . . . . *by Gunnar Skog*

The Tools for Gear Checking . . . . . *by Anders Jansson*

The Function of the Tool Engineer . . . . . *by Grant M. Wilcox, Jr.*

Formula for Circular Form Cutters . . . . . *by Theodore Weber, Jr.*

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Gadgets • Tools of Today • A.S.T.E. News • Andygrams • North, East, West, South in Industry • Index to Advertisers

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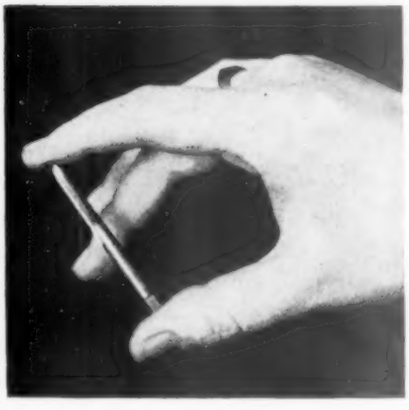

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AMERICAN SOCIETY OF TOOL ENGINEERS

Volume XVI **May, 1946** **Number 1**

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American Society of Tool Engineers

National Headquarters

1666 Penobscot Bldg. **Detroit 26, Michigan**

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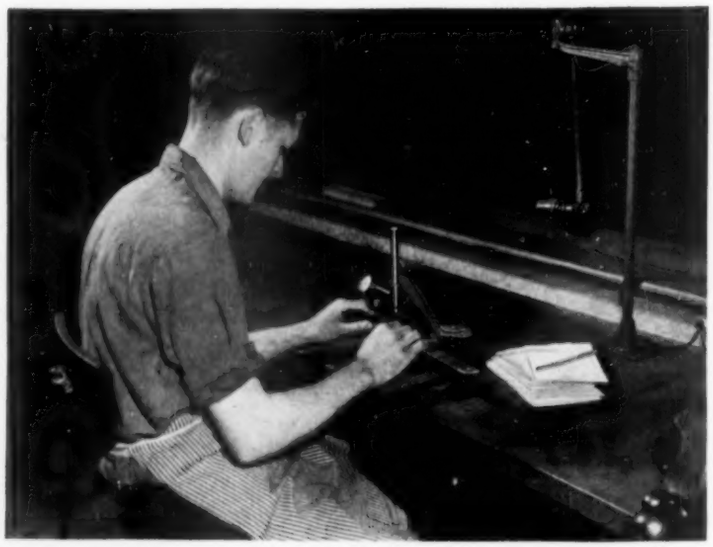

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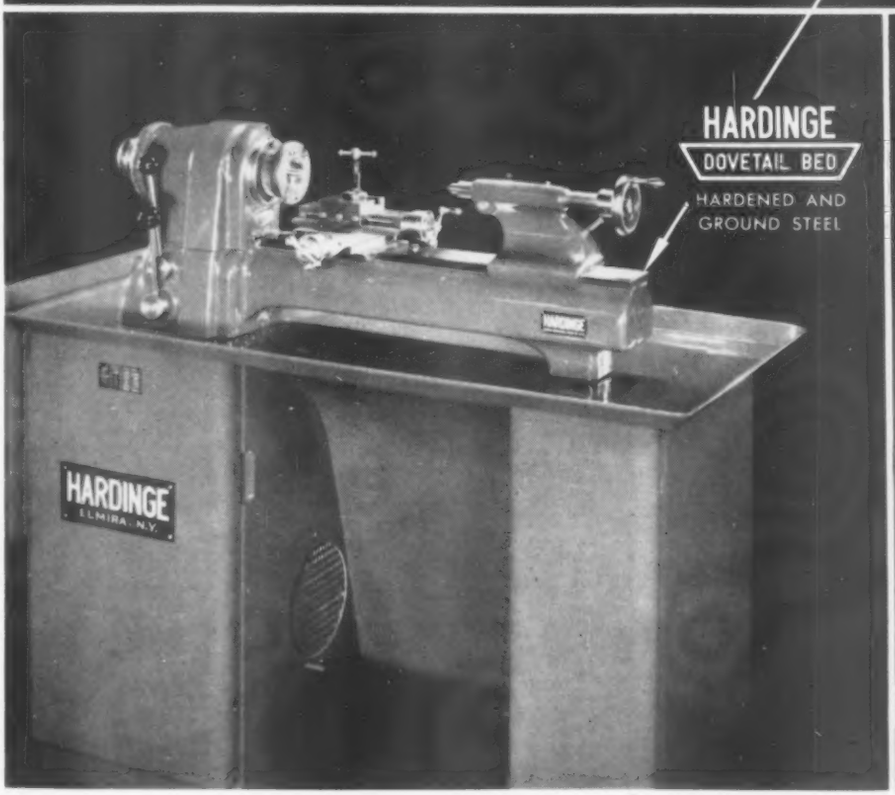

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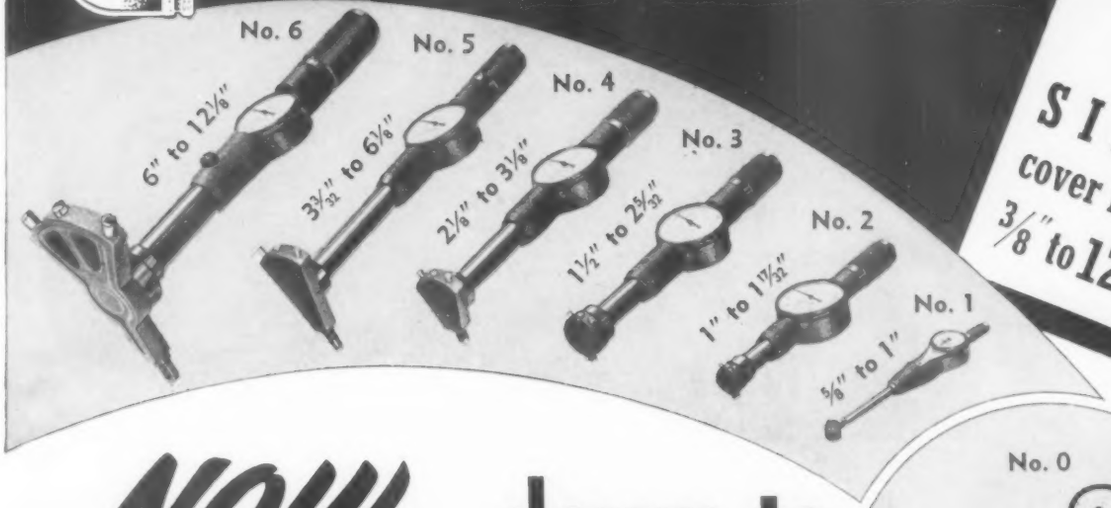
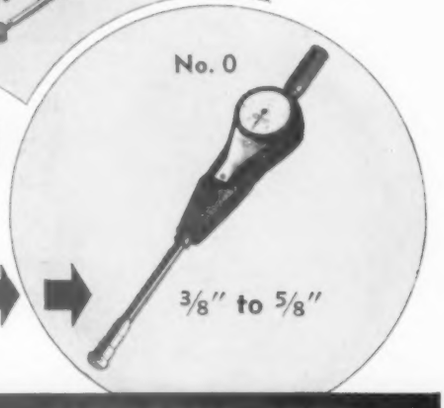
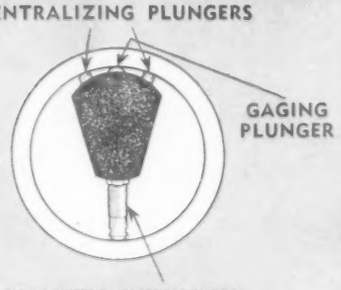


7 SIZES cover range ⅜" to 12⅛"

NOW...down to ⅜" bore ➡ ➡ ➡ ➡



STANDARD Centralizing Mechanism



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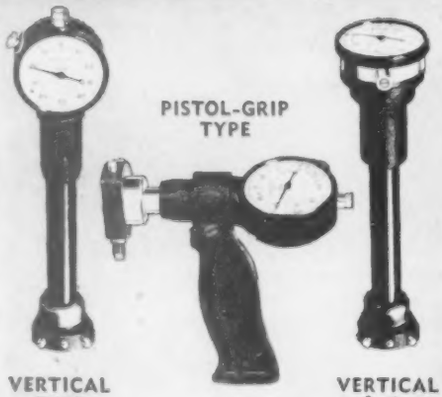

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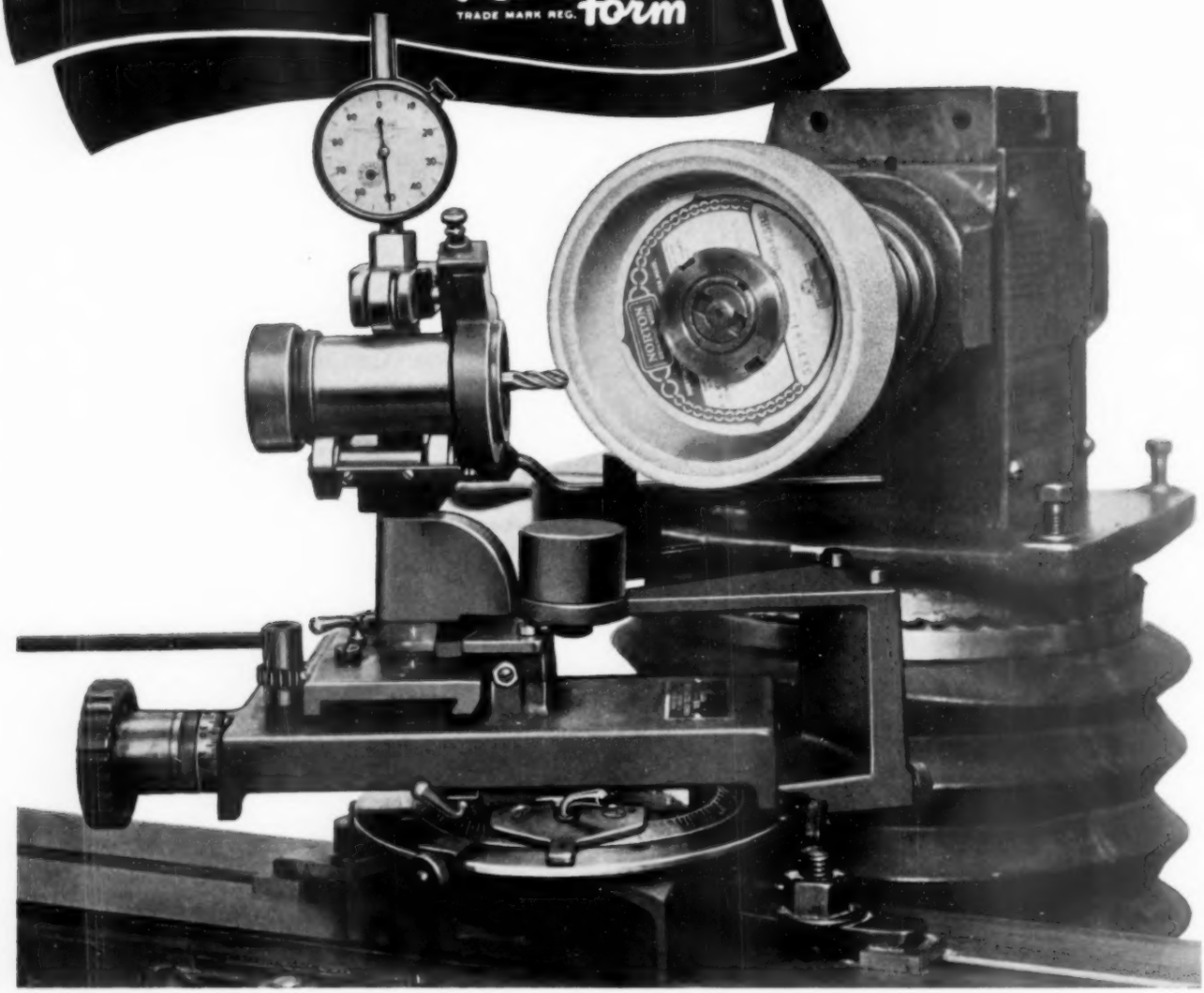

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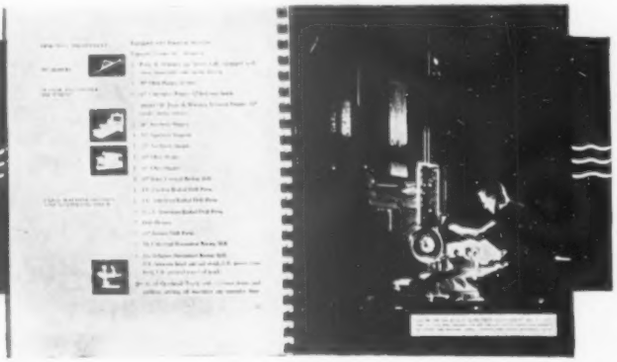
Item D 2 Interesting and well illustrated magazine articles by Vulcan's Head of Manufacturing Operations, Mr. Gordon Letsche, have appeared from time to time in various metal trade publications. They show how some difficult tooling problems have been solved. We will be glad to send reprints as long as our supply lasts.

Items D3 and D4 The twenty-four page brochure "Vulcan Service to you in the Post-War Economy" discusses the future of American business and the function of special mass production tools and techniques. Item four "For you it's important" is a broadside stating why Vulcan purchased a new plant and machinery.



Item 5 If you are interested in a facilities list describing one of the half dozen best equipped tool building plants in the Western Ohio area ask for item five and a broadside now in preparation will be sent you when ready. Meanwhile item three carrying a list owned prior to purchase of the new plant will be sent.

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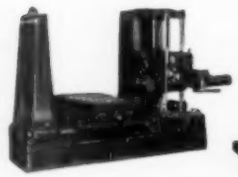
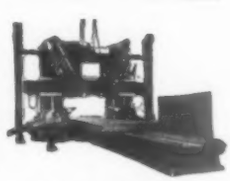


G. & L. Table Type Machine

G. & L. Floor Type Machine

G. & L. Planer Type Machine



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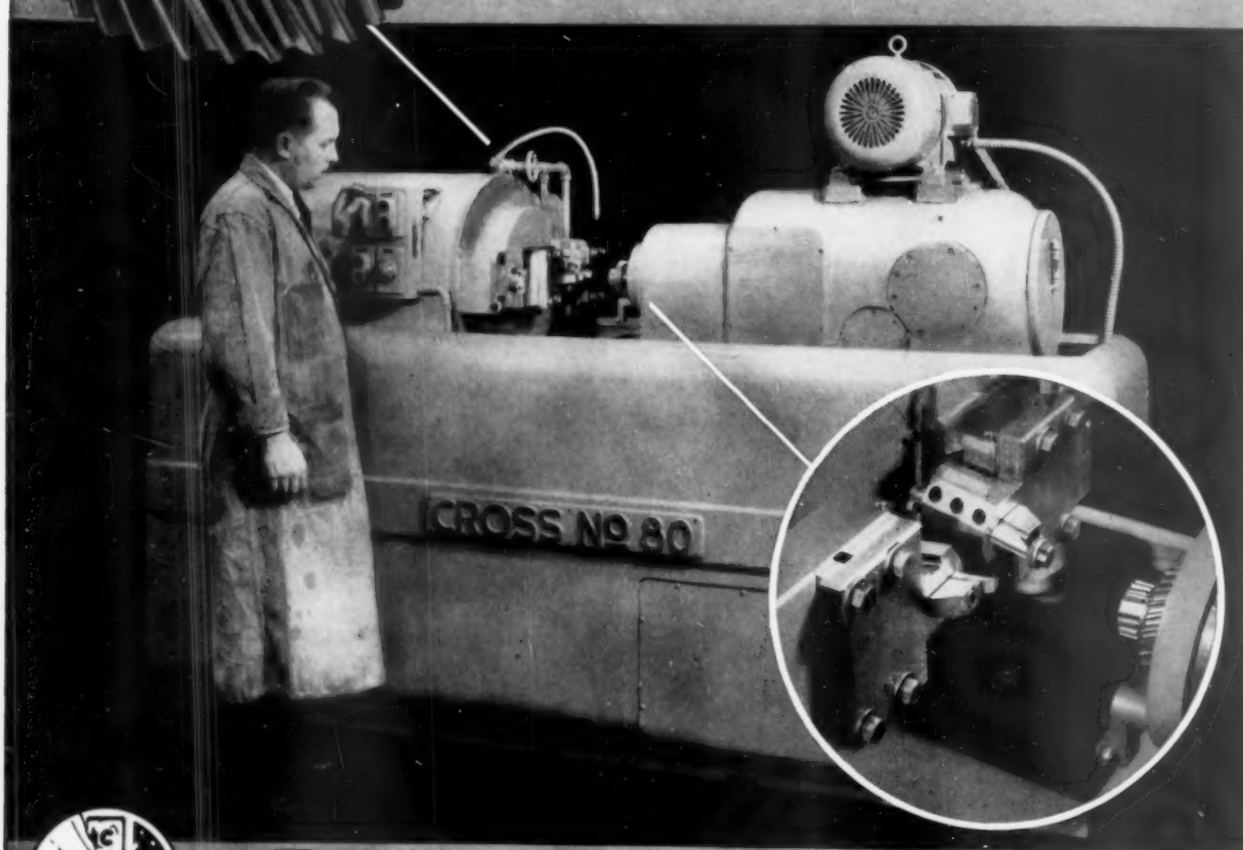

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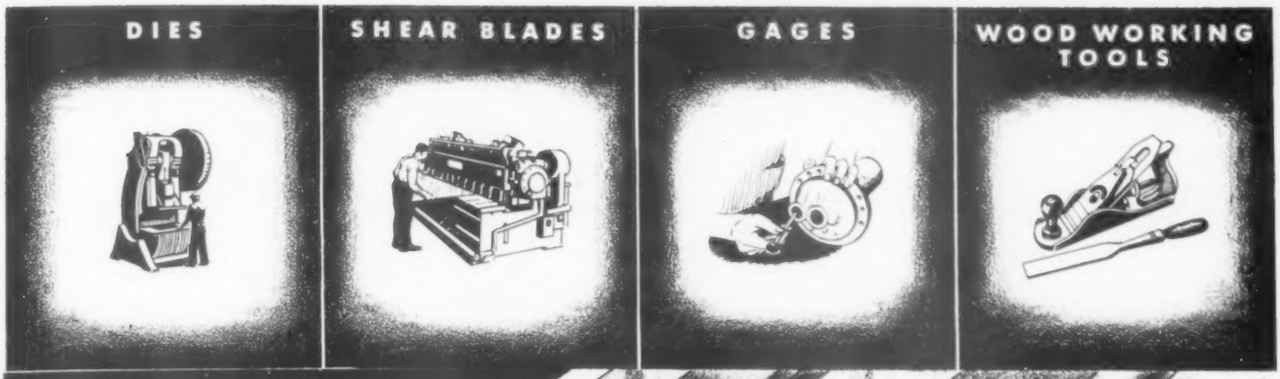

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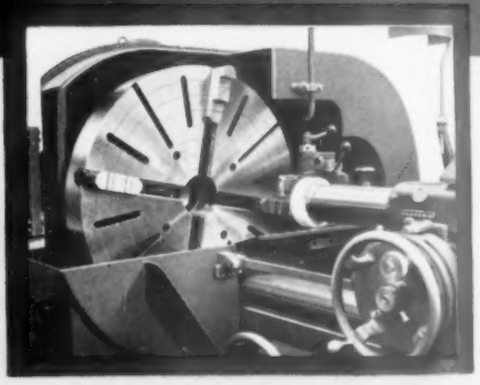

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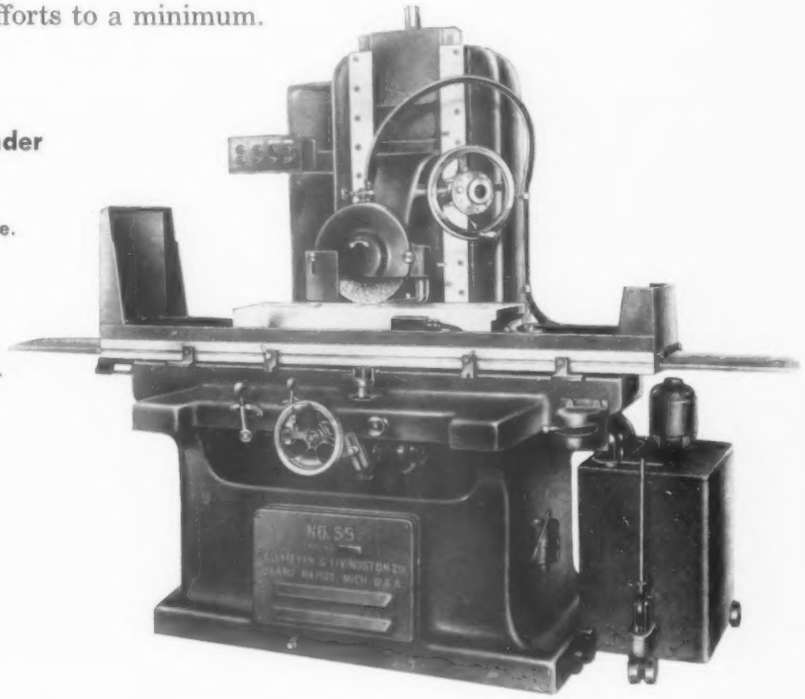

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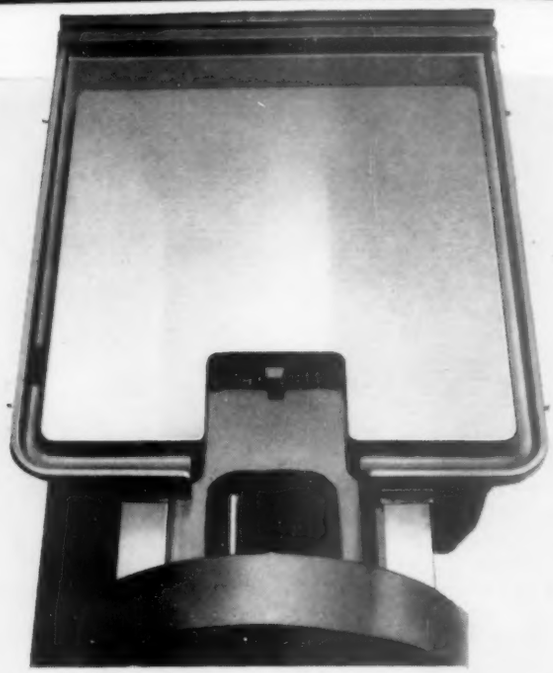

Its simplicity starts with this first basic idea: The use of this large horizontal table which makes it possible to place every tool in its most favorable working position. Here, a greater number of slides can be used. A greater variety of positions is possible. Angle feeds are no problem. Compound slides are unnecessary.

Tool set-up is simpler and more effective. With each slide individually cammed, all slides are independent of each other as to approach, order of engagement with work, rate of feed, dwell, and retract.

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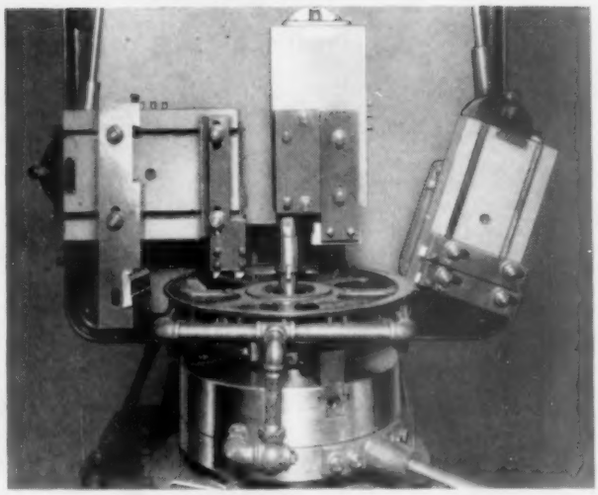

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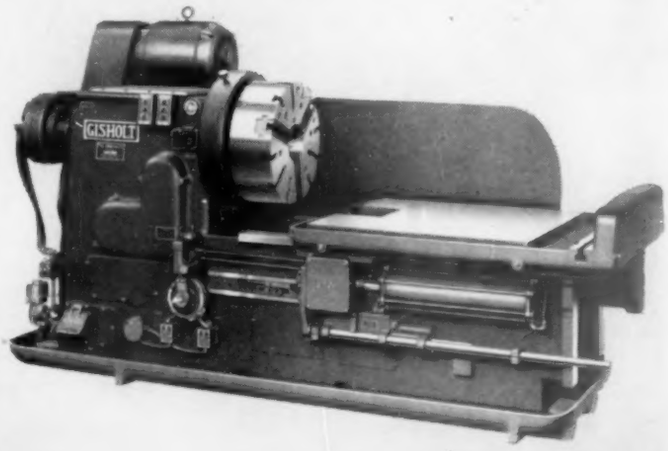

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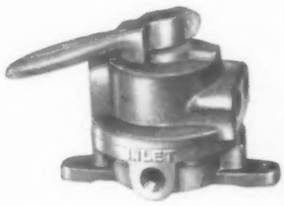

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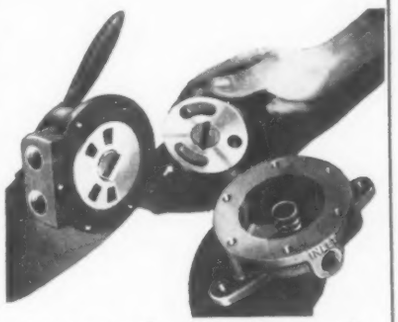

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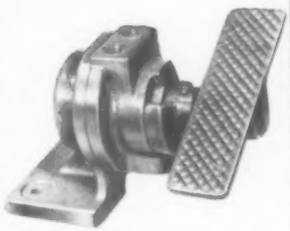

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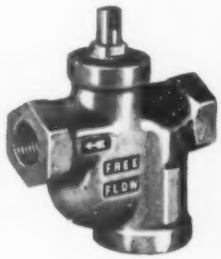

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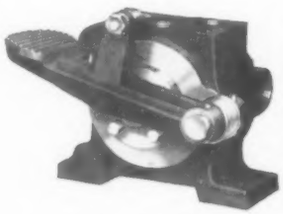

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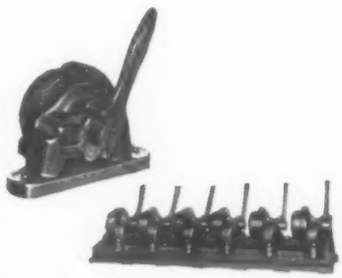

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The Course Is Charted

LOOKING back is not an appropriate theme to pursue for a new president in a new ASTE year. We must remember, nevertheless, that the reason we are what we are today as an engineering society of great prestige and size is because of the foundation that our great ASTE structure rests upon.

The last few years have been full of ideas and projects for ASTE. To those on the outside who fail to realize that tool engineers not only dream big things but *do* big things, some of these projects appeared impossible. For them, as proof, we have as our latest example the largest tool engineering exposition ever held in the United States.

At the Society's New Era Exposition at Cleveland, last month, over 53,000 vitally interested tool engineers, production experts, technicians and manufacturers inspected the latest development in the tool engineer's broad field of activity. They saw well over $2,500,000 worth of machinery and equipment in animated displays.

In the fifteenth year of its founding ASTE is well underway. The course of ASTE progress is clearly charted. As your newly elected executive head it is my express desire and intention to expedite and to further ASTE plans, programs and ambitions.

Of a less spectacular nature, but of great importance to ASTE and to every member, is the adoption by the entire membership, last year, of the revised constitution and by-laws. Of particular significance and value, in this regard, is the book of procedures. This section of our by-laws brings aim and purpose to all our many undertakings. It enables every member, every officer, every committee man, national or chapter, to know just exactly what his responsibilities are in his assigned or elected position in the Society.

It is this administration's avowed pledge to see to it that these new procedures are fully understood everywhere and that they are effectively utilized for the smooth operation, not only of ASTE national headquarters and executive groups, but for the chapters and the many committees as well.

The administration just past could well be termed an administration of plans and projects. The new administration is an extension of last year's, with special emphasis upon the correlation and implementation of all our programs, national and local, for the furtherance of ASTE and the profession of tool engineering.

In appraising the plan of procedure for Society work and activities, let us keep in mind that the purpose was primarily to provide a helpful guide. This, you will appreciate, was essential not only to aid new officers and committeemen in their newly assigned duties, but also to bring about consistent and effective operation of Society work and activities in general. We feel that the course of ASTE progress has been soundly charted. Now, all we need to do is to sail on that course.

President 1946-1947

By Erik Oberg

Voluntary Economic Methods versus Compulsory Economic Systems*

In which a Shaper of Contemporary Thought Presents the Case for the American Way.

While methods advocated by believers in this or that economic thought may evoke differences of opinion, there are certain fundamental truths about human affairs and human conduct that are merely facts and therefore not debatable. In presenting my subject, therefore, I will try to handle it as an inquiry into the facts. I am neither apologizing for nor defending any so-called economic system; rather, I propose to analyze as one would analyze a mathematical problem.

Yet, this thing comes very close to all of us in our daily lives and I have tried to reason as logically as possible and without personal bias, the while holding fast to personal convictions. Rather than mere assertions, I will picture the world as it is and human beings as they are, not as they might have been had they been created by the advocate of this or that idealistic system.

Erik Oberg **was born and educated in Sweden, where he received his M.E. degree and gained practical experience with the Bolinder Works. Coming to the U. S. at the turn of the century, he was employed by Pratt & Whitney, Co., Hartford, Conn., until 1906, when he joined *Machinery* as associate editor. From 1918 to date, he has been Editor of that publication.**

Much that is blamed on economic systems had nothing to do with the system itself. Human nature, and the imperfection of human behavior, should be blamed. There are many mean streaks in human nature, and many generous traits. Differences over economic systems are usually due to the fact that the advocate of some particular system concludes that it must be successful because, in his imagination, he works his system with people who are all generous and just; whereas, in his opinion, the system that he is decrying is worked entirely by people who are mean, unjust and selfish.

The truth is that any economic system depends upon the cross-section of all of us humans, people who—often at the same time—are mean, generous, selfish, loyal, unjust, kind, hard, self-sacrificing, friendly, cruel, fair and well-meaning. Until you recognize the fact that that is the way people are, it is no use discussing economic systems.

At this point, I want to acknowledge my indebtedness to Prof. Thomas Carver, formerly of Harvard University, for many of the ideas and the information that has been made use of in this article. Of course, it is not possible, in a limited space, to comprehensively cover a subject of this kind. All that can be attempted is to start a train of thought somewhat different from that ordinarily pursued along economic thinking and to point out fundamentals that are often overlooked in discussing such vague subjects as the capitalistic system, socialism, communism, and so forth.

*Resume of talk, by the author, at several A.S.T.E. Chapters.

The American Voluntary Economic Plan

The economic methods under which we conduct business is frequently labeled the capitalistic system. One point I would bring out is that it is not a system at all. The word "system" implies a rigid form of procedure, and our economic methods are not subject to any such rigid form. Socialism, as practiced in the Soviet Republics, is a system—a compulsory system. The Nazi conceptions were based on a compulsory system. I shall show that our economic methods, in peacetime, did not comprise a compulsory system although policies recently inaugurated are socialistic in their tendencies, and to that extent point toward a compulsory economic system. In speaking of our economic methods, then, I refer to the methods under which this nation developed for about a century and a half since its independence.

If these methods are not to be classified as a system, how then should we label them? The methods that (for lack of a better name) we may label the American economic plan, can best be described as a *voluntary economic plan* under which men work together on the basis of voluntary agreements, rather than on the basis of coercion or compulsion authorized by law. The essential point to remember is that it is a *voluntary* economic plan. In calling it "American," we should not be unmindful of the fact that it is just as much British or Scandinavian, or that half a dozen other national names could be applied; but I have used "American" because, here, it reached its highest development under the fullest forms of economic freedom.

Frequently, our economic methods have been labeled the *competitive* system; yet it is not essentially a competitive system except as competition will exist under any voluntary plan. It has been called the *capitalistic* system, and yet it is not a compulsory capitalistic system although capitalism will exist under any economic plan in the absence of government compulsion and coercion.

It has been called a system of *private property*, and yet it is not essentially such. Although private property will normally exist under any voluntary plan, there is no coercion on the part of the government to force anybody to

Erik Oberg, editor of *Machinery* and dean in the technical publications field, needs no introduction to our readers. A trained engineer, widely travelled and author of many books and articles, with a reputation for clear thinking, he has long been a force for progress in the industrial world—a shaper of contemporary thought.

While this article, by Mr. Oberg, is not "technical" in that it does not deal directly with tools and machines, it nevertheless presents the case for the spirit of emulation—the will to excel!—that, to a considerable extent, has inspired their evolution.

And what price our machine civilization, with its conveniences and luxuries, if we cannot preserve the initiative which has been the very well spring of its creation? What benefit technical education if we cannot include, with it, a design for living and an appreciation of human values?

At a time of confused thinking, this article, by a man who has made the study of economics an avocation, may be likened to a beacon, guiding young and old alike to a fuller realization of the meaning and truth of the American plan of free enterprise.

Andrew E. Rylander

Technical Editor.

own private property, or to say that all property shall be privately owned. And, finally, it has been labeled the *profit* system, because there will always be so-called profits wherever men are free to work and do business on their own initiative. Some will work for themselves and get what are called "profits"; others will ask somebody else to employ them, and get wages.

The American voluntary economic plan under which this country has prospered and made most singular progress for a century and a half, is more fundamental than indicated by any of the labels of capitalistic, private property, competitive, or profit system that are so often used to designate our economic methods. Perhaps the most fundamental characteristics of our voluntary economic plan is that it depends for its existence on comparative freedom from violence; freedom of individuals to work together by voluntary agreement; freedom to own, to buy, and to sell; and the right to enjoy what one has produced or purchased without compulsion or coercion on the part of the government.

Function of Government Under a Voluntary Economic Plan

Fundamentally, therefore, there are only two economic plans or systems—the *voluntary* and the *compulsory*. Under the first, we need government with certain powers. Government must have the power of compulsion in order to create equitable opportunities for all and to maintain the greater freedom that exists under such an economic plan. The traffic policeman has power to stop and start traffic, but the object of that power is to make the traffic move with greater ease; and so the government in a nation, working on the voluntary economic plan, uses its authority to suppress the few who would attempt to interfere with the equitable and orderly methods of producing and exchanging useful products.

If the traffic policeman abuses his power—goes too far and uses too much authority—he interferes with the easy movement of traffic; and, in the same way, men in governmental authority may be tempted to use too much authority and in that way may impede the orderly process of business, prevent the expansion of industry, increase unemployment, and start a nation economically down-hill. There are those who believe that the policies of our Federal Government, in the late thirties while we were still at peace, tended in that direction; but, there are many who still have faith in compulsory methods and who advocate them and would like to continue many of the wartime restrictions in the years of peace to come.

Now, the opposite to the American voluntary economic plan is a compulsory economic system. A mixture of the two is not possible—at least, it cannot permanently endure. Governmental authority, so long as it merely enlarges the field of voluntary activity and business by agreement between the citizens, by suppressing violence and fraud, insures a permanent voluntary economic plan. Any further extension of government authority prevents the expansion of industry and thereby increases unemployment. It plays into the hands of those who believe in a compulsory system and gives them excuses for more and more repressive legislation which is likely to cause still more unemployment, due, not to too much freedom on the part of the individual to conduct business, but to repression of individual initiative. The next step, then, is complete compulsory regimentation similar to the Soviet and the late German or Italian pattern.

Under the voluntary economic plan, the only way anyone can legitimately get anything for himself is either to produce it or to get it from someone else with that person's consent. Under the compulsory system men are organized—as in any army—on the basis of authority of a few and obedience on the part of the many. Under this system, the individual gets what he is permitted to have. As a rule, no one who thoroughly understands the nature of the compulsory system advocates it, except those who expect to be in positions of authority, under that system, where they can *give* commands instead of having to *obey* commands.

Any Economic System May Be in Use Under the Voluntary Plan

Now, then, what do we mean when we say that our present American economic plan is a voluntary plan? We mean exactly that. Under the plan on which this nation was founded, individuals are permitted to adopt practically any system that they please, provided enough of them are willing to cooperate in its adoption. Our economic plan permits the private ownership of capital and of the communal ownership of capital. It also permits competition and any form of cooperation.

Any group is as free, in this country, to start a communistic economic society or ownership group as it is to start an incorporated company, so long as the organization is a voluntary one. In proof of this, more than sixty communistic societies or ownership groups have existed in this country at various times and places. The term communistic societies does not imply associations of communists or communistic parties, but communities that voluntarily agreed to apply communistic principles to the everyday life in their community. Nobody interfered with their communism, nor were they permitted to interfere with those who did not care to join them.

So long as this communism was voluntary and not coercive, it fitted in with our economic plan just as well as capitalism. It has not been in accordance with the American conception of freedom to suppress voluntary communism by authority any more than to suppress voluntary capitalism by authority. The government has imposed no more regulations on the communistic ownership groups than on the capitalistic groups—if anything, probably less—and it has protected the communities that own their property in common just as well as it has protected those who preferred individual or private ownership.

Now, then, since men have been equally free to organize communistic ownership groups of the voluntary kind and capitalistic companies, why is it that the communistic groups have not flourished but, with only two or three exceptions, have died out? They did not die out because the laws suppressed them; obviously, then, they died because those who belonged to the group got tired of the communistic ownership idea and preferred individual property.

It is a curious, but not surprising fact that, generally, the young members of these groups first got tired of applied communism. The young do not like the repression of the communistic plan, and since under our laws they could not be *coerced* into acquiescence, they left the communal organization for what they apparently thought were the greater opportunities elsewhere.

Certainly it is of interest that, for the last twenty years while men have stood on street corners preaching the blessings of communism in Russia, these very men have shown no great desire to partake of these blessings by going to Russia and living under the conditions there. They were free not to accept practical communism, and, being free, did not accept it but continued to live in a capitalistic country, preaching communism but carefully refraining from practicing it.

Why Do We Say "The Competitive System?"

Many who try to describe our present economic plan are like the blind men of India who went to "see" an elephant. One touched the elephant's leg, another the main part of his body and yet another his trunk, and each accordingly

described the animal as a tree, a bridge and as an enormously big snake. Our economic plan is so vast that it is difficult to conceive of it as a whole. Each observer, therefore, picks out one of its many features and describes the voluntary economic plan in terms of that single feature. Hence, for example, we get the term—the *competitive* system.

One observer may note that, under our economic plan, there is a great deal of competition; hence, he calls it the *competitive system*. Our voluntary economic plan permits competition in useful or harmless activities, and since man is normally competitive, there naturally would be competition. But our economic plan also permits cooperation in useful and harmless activities, hence, there is a great deal of cooperation because man is also normally cooperative.

Whether there is more competition than cooperation in our business and economic life is a mooted question. But if there is, it is not because cooperation is suppressed or competition ordered by law, but because we, the people, when let alone, are likely to compete more than we will cooperate. Our plan is permissive—that is, it permits us to compete or cooperate according to our own preferences and our ability to get along with our neighbors.

Every corporation and partnership is an example of cooperation. In our largest companies, tens of thousands of men cooperate by putting their savings into a common pool so that enormously large factories equipped with marvelous machinery for the manufacture of all kinds of products may come into existence. Only in the most exceptional instances would any one individual have enough capital to create such a plant. Practically our entire industry is built on such cooperation.

Again, cooperation no less than competition is not in itself a virtue. Both cooperation and competition may be extremely harmful if applied to harmful activities. As such, both cooperation and competition are properly suppressed. There may be, and frequently is, cooperation among criminals; the mere fact that there is cooperation does not *commend* it. Neither does the fact that an enterprise is competitive *condemn* it; there is such a thing as rivalry in producing the best.

Those who describe our plan as competitive, and condemn it because it is competitive, do not recognize that democracy itself is competitive; there is a tremendous amount of competition for office and for positions of power. Every election is an extreme example of competition. If we can conceive of communism under a democratic system (an example of which the world has not yet seen) such a democratic communism would be quite as competitive as our present economic system. It would eliminate competition in production, in buying, and in selling; instead, there would be violent competition in politics, in running for office, and in seeking positions of authority and power.

Competitive bids for votes are quite as intense as competitive bids for business, and frequently less honest. The competition would change from trying to obtain financial strength and power to obtaining political strength and power. In fact, practices are being employed today, to which all the objections may be applied that have been raised against competitive business.

To summarize, the American economic plan—as practiced in the past—permitted cooperation as well as competition. It was built up through quite as much cooperation as competition; hence, it is hardly correct to describe it as the competitive system.

Is Our Economic Plan a Private Property System?

Still other observers have noticed that the American economic plan permits a great deal of private property. They look upon this as the outstanding characteristic of the plan and call it the *system of private property*. Of course, private property is permitted under the plan, and there is a great deal of private property on that account. There is also a great deal of public property.

Now, why is it that there is private property under our economic plan? It is because the primary function of government has been to suppress violence and fraud. It is the repression of violence and fraud that creates private property. No government ever did or ever could eliminate violence and fraud without, in the very act of doing so, creating private property.

In the absence of violence and fraud, when a man has produced something, he can call it his own; and since he can call it his own, he can also give it away or sell it. When he has so transferred it, somebody else can call it his own and keep it or transfer it as he wishes. When a man is permitted to call it his own and to keep it or transfer it as he prefers, it means that he cannot be dispossessed without his consent, except by the government itself.

As long as the government suppresses fraud and violence, there will be private property. But government itself—as we have seen in recent instances abroad—can resort to violence and thereby deprive individuals by force of that which they formerly could call their own. So we see that violence or fraud may be committed both by private individuals, which we call criminals, or by the government itself. Government can destroy private property in two ways:—first, by refusing to interfere while men of violence dispossess men of peace; and, second, by the government itself dispossessing those who are under its power.

The sum and substance is that private property is not a fundamental characteristic of our economic plan; it is a secondary result of the relative absence of violence and fraud. Were men of violence and fraud to predominate, then no one could possess anything which a stronger or more cunning man wants, and there could be no private property. But if men of peace and honesty predominate over men of violence and fraud, the latter will be repressed and there will be private property. The economic plan or system, as such, does not contemplate private property as much as it does the repression of violence and fraud.

Many who describe our economic plan as a system of private property say that the laws for the suppression of violence and fraud are made for the purpose of protecting property. Does that explanation bear examination? Laws for the suppression of violence and fraud were originally made for the purpose of suppressing violence and fraud. Violence and fraud are anti-social acts and no group of men could hope to live together comfortably and to prosper if they did not suppress them. It is just as illegal to defraud a worker of his wages as it is to defraud a house owner of his house; and it is fully as serious an offense to hit a property-less policeman over the head as to hit a bloated capitalist. If you don't believe it, try it!

Property Rights versus Human Rights

Another idea worthy of examining is that embodied in the slogan "human rights versus property rights." Like many other slogans, this one was probably invented for the purpose of gentle deception. Slogans are easy to take and believe. Yet this one is misleading, first, because it suggests that property has rights; and, second, in suggesting that those rights are in some way antagonistic to human rights. As a matter of fact, property can have no rights; only human beings can have rights. Among these we recognize the right to own what one has produced; this carries with it the human right to sell what one owns.

If one human being has the right to sell, someone else must have the right to buy. Hence, property, as such, has no rights, but the possession of property is recognized as

a human right. If that is the case, there can be no possible antagonism between property rights and human rights. If we deny the human right of possessing what one has produced or acquired by purchase from the producer, then, to be sure, there can be no private property. But the only way in which a man can be deprived of that which he has produced, or its equivalent, is by force or violence on the part of robbers or on the part of government.

The Capitalistic System

And now we come to the most general term of them all for describing our American economic plan, and that is the *capitalistic* system. The reason for this is that, in any advanced civilization, capital plays a large part in production. A great deal of the capital is privately owned.

First, what is capital? Capital is not money as such, because in forms of paper or gold it is practically useless. Capital, as used in industry, is in the form of buildings, machines, and equipment for producing all kinds of products wanted by mankind. The private ownership of capital—that is, of buildings and machines for manufacturing other products—does not differ fundamentally from the private ownership of a house, or an automobile, or a sailboat, except that capital permits of the production of more of the things wanted by all of us for our well-being and comfort.

Capital consists of the tools of production. In that sense, capital has existed as long as tools have existed, for all tools are capital. Because of industrial progress, invention and the cooperation of those who have savings to invest, the tools of production have greatly increased in number, size, and complexity, and have come to play a much larger part in industry than they did before the invention of power-driven machinery. In this sense only does modern capitalism differ from that of earlier times. Capital plays a larger role now than it could possibly have played when it was represented only by small and inexpensive tools or primitive machines.

Probably the great objection to capital's part in industry is due to the fact that most rich men are capitalists—that is, it is the rich men who provide the wherewith to get the buildings and buy the machines and other equipment necessary to manufacture the goods wanted by all of us.

Now, somehow, there is a feeling, at large, that being rich is somewhat of a crime; hence, the words "capitalist" and "capital" itself are in bad repute. If the rich man has acquired his wealth dishonestly, there certainly is cause for criticism, but simply that a man is rich is no evidence of dishonest practices. There are thousands of small business and working men who are also dishonest. Dishonesty is in no way confined to any one class. This, however, is beside the mark. The main point is that the owner of wealth today can get little benefit from his wealth unless he makes it work for someone else. Somehow, he must share the benefits of his wealth or he will get no benefit for himself.

A factory, for example, is worth nothing to its owner unless he makes it produce something that others want. He cannot operate it alone, but must employ others to help him. And in the case of most manufactured products, the greater part of the money paid by the purchasers of the product will go to salaries and wages. If there is anything left, the owner gets it; if there is nothing left, he gets nothing; and if there is a loss—as there frequently is—he pays it.

The point is that the owner of capital must share the benefit of his wealth both with his customers, who want the goods that he produces, and his helpers, who look to him for employment. If he does not share in this manner, his capital is worth nothing to him. In the past, when the rich man's wealth consisted mainly of articles of luxury, large mansions, land, and the ability to keep many servants, his wealth benefited mainly himself and his favorites. Today, however, the investment of capital in manufacturing businesses has caused a greater distribution of wealth, not less distribution. It has brought about more concentration of power, but not actually more concentration of wealth.

There is, however, something more fundamental about our American economic plan than the use of the capital of a wealthy individual. The important point is that our economic plan permits individuals, as groups, to pool their resources and own and use capital on a larger scale than each could individually. Only a repressive form of government could prevent an enlightened people from using, to the fullest extent, the instruments of production—that is, capital. Only a dictatorial government would reserve to itself the right to own all the means of production, forbidding individuals to own it. Nothing, therefore, can prevent the private ownership of capital except forcible dispossession—that is, dispossession and threats of violence against those who accumulate it.

Again we return to the idea that while our economic plan permits the private ownership of capital, it also permits the communal ownership of capital; that is, it permits voluntary communism as we have already mentioned. There is nothing whatever in our governmental or economic setup that would prevent, for example, the people of Erie, Pa., from getting together and living under a communistic or socialistic economic system. They could own, in common, their bakeries, newspapers and printing shops, their manufacturing plants, their transportation systems (as in Detroit) and anything else that was required for their daily life. The reason that they do not do this is because, apparently, the majority does not think that it would be a good idea. But, those who voluntarily wish to enter upon such a communal plan have a perfect right to do so. That is the reason why we call our present plan the American *voluntary* plan.

Why Have There Been So Many Communistic Experiments in America?

It is not mere chance that there should have been more communistic experiments put into actual practice in the United States than in any other country in the world. It is because, when these experiments were particularly fashionable, this was the most free country in the world. All these experiments were started when this really was a free country. They were all of the voluntary and not of the compulsory kind of communism. If a man did not want to be a communist and share with the rest, he did not have to. There were no dictators with big sticks and firing squads to teach individualists to love communism. Since this was a free country, voluntary communism was permitted; but compulsory communism would not have been permitted because that type of communism cannot fit into the institutions of any free or truly democratic country.

And here we come to the crux of the whole matter. These experiments did not succeed or become permanent because *men were free to quit whenever they pleased*. The communist on the street corner does not believe in that freedom. *He wants to force his economic system on people who do not want it*.

Of course, there are many who will say that the reason why these experiments in communism failed was because they were not tried on a large-enough scale. But that is not what they really mean. What they mean is that these communists did not have a government that compelled acquiescence and obedience—a government of force!

When the theoretical communist explains that these communistic experiments were handicapped by being small units in a vast area of capitalism, he merely admits that the common run of men, if left to themselves, prefer what has been called capitalism to communism. These experiments failed because men were free to choose—free to join com-

munistic or capitalistic units according to their preference—and the great majority has always chosen capitalism.

Another point that is worth noting is this: Capitalism has apparently nothing to fear from communism so long as men are free to choose that which they like better. There is no objection to the trying of communistic experiments, so long as everything remains on a voluntary basis, and both groups are treated alike by the government.

On the other hand, it appears that communism has a great deal to fear from capitalism. In communistic states they do not dare to permit capitalistic enterprises to start. They do not dare to offer the same protection to capitalistic enterprises as they do to communistic efforts. In fact, they use the strong hand of government to suppress even belief in a voluntary economic system, and the record shows how, in Russia, a great many prominent men have been "liquidated" simply because they had lost faith in communism.

Hence, in a really free country, there is no danger in giving a free hand to actual communistic ownership experiments and to give them the same protection and the same opportunities as capitalistic enterprises. Because, briefly, capitalism has proved that it can stand competition with communism; but communism, through its very compulsory attitude, indicates that it cannot stand free competition with capitalism—and that practically closes the argument.

Profits and the Profit System

Finally, our voluntary economic plan has frequently been called the *profit* system, and profits apparently are something that a man should be ashamed of making. Those who speak of the profit system have noted that many who play an important part in our economic system are not guaranteed a wage, salary, or fee by anybody. They see how men who have no assured income of any kind manage to get along. These are the business men who have a contingent income. Whether these men get any income at all or not is contingent upon the outcome of their business ventures. As said previously, if anything is left after these men have paid everybody else for their work, they get what is left—that is, they make a profit. If nothing is left, they get no income, and if the venture is unsuccessful, they even suffer a loss. Nevertheless, profits are often spoken of as if somebody who makes a profit had robbed somebody else.

Now let us examine into the character of so-called profits. To make a profit, generally, a man has to invest a certain amount of money—possibly all of his savings. To that extent, therefore, the profit is simply interest on his money. Again, he puts in his time and labor to make the venture successful, to manage the business, and to sell the products to customers who want them. To the extent that he does this, he is entitled to salary or wages, so that a fair proportion of his so-called profits are merely compensation for work performed.

The same reasoning that has been applied to an individual may apply to larger enterprises carried on by groups of men and known as companies or corporations. They, like the independent business men, receive incomes contingent on the success of the enterprise. No one contracts to pay them any returns on the money invested. If there is anything left after expenses—including wages, salaries, interest, rent, and taxes—are all paid, then the stockholders get a dividend. But to a large extent, this dividend is simply interest on the money invested.

Because those who take the initiative in developing industries, business, or trade—whether as individuals or as corporations—receive only contingent incomes, called profits, our voluntary economic plan is often referred to as the profit system.

It is true that these men, who direct industry and business, work for what we call profits rather than wages, salaries, or interest. They have to, because no one guarantees them anything. The great majority of people, however, work for wages. Our economic plan might, therefore, just as well be called the *wage system* as the *profit system*, and that it is often done. It is an open question whether the profit motive is any more selfish or otherwise reprehensible than the wage or the salary motive. In each case, a man tries to get all he can according to his ability to get it. Whether men choose to get returns in the form of profits, or in the form of wages and salaries, depends entirely upon the fact that ours is a voluntary economic plan.

Some men like to assume responsibility and others like to shift responsibility. Some men do their most productive work by telling others what to do, whereas others can only work when somebody gives them directions. The best evidence of this was seen during the recent depression. Millions of men were unemployed *because they did not know how to employ themselves*. They had to be directed by somebody else if they were to be able to make a living. Somebody had to provide them with a job and guarantee them a wage, but, the man who provided the job and guaranteed the wage had no one to direct him nor to guarantee him an income.

The voluntary economic plan under which we work permits each to use his talents and abilities in the group where he is best fitted. If one has more of the spirit of enterprise than another, he will make a voluntary agreement with the other to guarantee him a wage if he will work according to directions. For that reason, in any free community there will always be a profit-seeker and a wage-seeker. If left alone, a large number of the men who have the enterprise to hope for profits may join together and make similar agreements with large numbers of the wage-seekers. Then we have what we call a large corporation.

Briefly, the so-called profit system is simply one aspect of the larger system which is the voluntary economic plan. Under such a plan some will work for profits, some for wages, some for fees. Some will spend all their incomes, others will save and accumulate. These latter groups become the owners of private property. They will invest capital in enterprises to produce more goods. They will be stimulated by the hope of making profits. In so doing, they will have to compete with others who have entered on similar enterprises, to produce better goods or goods for less money.

Conclusion

And so we find that our American voluntary economic plan embodies competition, cooperation, private property, public property, private capital investments, communal ownership, wages, fees, and profits. But none of these are compulsory under the plan. They are merely the normal and natural outgrowth of a community in which men are free to voluntarily choose the kind of economic plan under which they think they can work the best.

But any economic system—socialistic, communistic, or whatever you wish to call it—can be worked freely and unhampered under the American voluntary economic plan if there are a sufficient number of people who wish to do so. It is not correct to speak of our voluntary capitalistic plan as if it were in principle opposed to a compulsory economic plan like socialism, because even socialism can be practiced under our voluntary economic plan.

There is no such thing as a capitalistic system, a private property system, or profit system, in the sense that it is forced upon the community by the government. The economic methods that we have were accepted by free choice. Any group of people can operate any other system, voluntarily, if they please. And in this, the American voluntary economic plan differs fundamentally from the compulsory conceptions of communism and socialism, national or otherwise, that have gained ground elsewhere in the world.

By Dr. Russel A. Nielson

Effect of Frequency in Induction Heating

In which Involved Problems in Induction Heating, Are Approached from the Fundamental Viewpoint and Answered in Simple Terms. *

What frequency is best for induction heating? For dielectric heating? These questions arise whenever high frequency heating is discussed. Formulae, entailing higher mathematics, determine the answer to these questions. But, since a better understanding can be grasped from the fundamental point of view, this method will be used in this discussion.

Introduction to frequency heating will begin with the application of very low frequencies and progress up the scale to frequencies as high as one hundred million cycles per second, and will cover induction heating, which is the heating of conducting materials. (Dielectric heating, which is the heating of insulating materials, will not be discussed.)

Induction Heating

While a complicated formula is frequently used to determine the watts into the load for induction heating, a method that is very understandable gives a good approximation of the power into the load. The first step is to investigate where the current flows in a conducting material. Once this is understood it is easy to comprehend why power is generated non-uniformly in a conducting material heated inductively by alternating current.

Consider, for example, a round conductor divided into 3 concentric circular sections marked A, B and C, Fig. 1. Each section may be considered as an inductance and a resistance in series. Section A is linked by the flux generated by the total of the currents flowing in sections A, B and C; its inductance is, therefore, the maximum. Section B is linked by the flux due to the current flowing in B and C and by the flux from only part of the current in A; inductance is, therefore, less than that of A. As section C links still less flux, its inductance is the minimum. If the resistivity of the cylinder is uniform, the impedance of A is greater than that of B which is in turn greater than that of C. Therefore, more current per unit of area will flow through C than through the interior parts of the cylinder. The current actually drops off exponentially from the surface as shown in Fig. 2.

Because the current tends to stay near the outer surface, this phenomenon is referred to as "skin effect." Fig. 2 applies for all frequencies; only a different "distance scale" is used. In Fig. 3 a distance scale has been established in units of delta. Since the current curve is exponential, it is convenient to choose delta as the distance where the current is 1/e of its surface value (1/e = 1/2.718 = .368). At the distance two delta, the current is 1/e of its value at one delta—i.e. .135 of its surface value.

The heating effect or I^2R loss can also be determined by adding another scale to the ordinate of this curve. Thus the power generated at the distance delta from the surface is approximately 1/8 of its surface value. In fact, 85% of the total heat generated in the cylinder, is generated in the region less than one delta from the surface.

Delta, which is shown as "the depth of penetration," can be defined as follows:

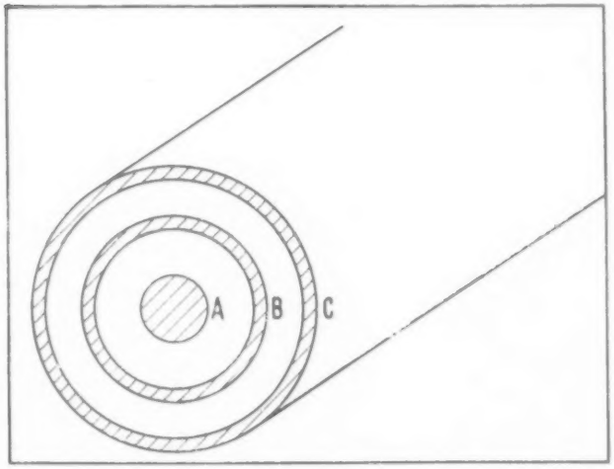
Delta = 3170 × rho/mu.f inches

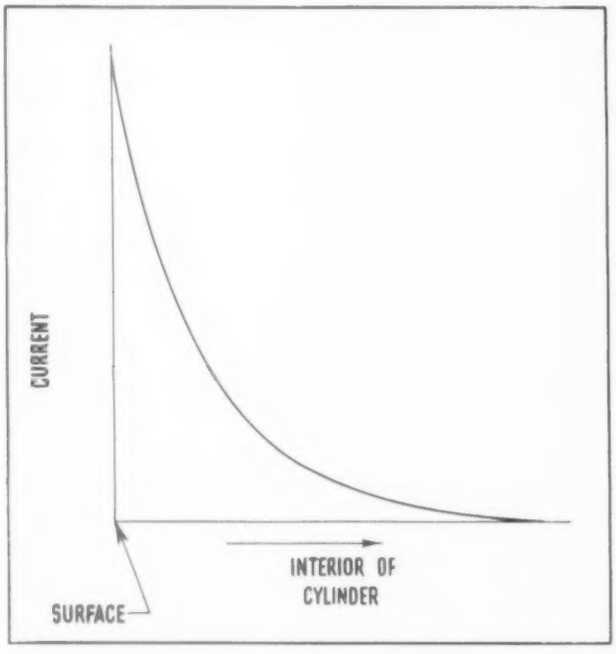
where

rho = resistivity of the cylinder (ohm inches); f = frequency in cycles, and mu = permeability (equals unity for non-magnetic materials).

For a general illustration of induction heating, consider a 3 inch diameter cylinder surrounded by a work coil as shown in Fig. 4. Alternating current flowing in the work coil induces current to flow around the periphery of the cylinder, being a maximum at the surface and decreasing towards the center according to the formula for the depth of penetration of the current.

FIG. 1 at left. FIG. 2 below.





*Condensed from a recent talk given before the High Frequency Heating Conference, sponsored by the Pacific Coast Electrical Association, at Los Angeles, California. Dr. Nielson is Manager, High Frequency Laboratory, Westinghouse Electric Corp'n, Los Angeles, Calif.

By putting the values applicable in this example into our formula, it is possible to find out exactly where the current flows in the cylinder that is to be heated. For copper, at room temperature, and 60 cycle current the depth is:

Delta = $3170 \sqrt{.66 \times 10^{-6}/1 \times 60} = .33$ inches

The current pattern is therefore as shown in Fig. 5, and 85% of the heat will be generated within $\frac{1}{3}$ inch of the surface.

It is frequently convenient to consider all current flowing around the piece as distributed uniformly across a section of thickness delta. Then, knowing the resistivity of the material and the average length of the current path, the power dissipated in the load can be calculated. This will give a value for power loss equivalent to that obtained by integrating the actual power loss over the entire cylinder. For example, in the case of the 3 inch copper cylinder, the depth of penetration was $\frac{1}{3}$ inch and the path length was the periphery of the cylinder. If a one inch length of the cylinder is considered, then the power dissipated is:

Watts per inch of cylinder length = I^2R

= (Amps/inch of cylinder)^2 × periphery/delta × rho

or if a path along the periphery only one inch long is considered:

W/in^2 into cylinder surface = (amps/in)^2 × rho/delta

W/in^2 = (amp/in)^2 × rho × 1/3170 $\sqrt{\text{mu.f/rho}}$ =

= (amps/in)^2 × $3.16 \times 10^{-4} \sqrt{\text{mu.f/rho}}$

The only unknown is the current flowing around the cylinder. In the foregoing example, if the cylinder is put into a long coil, it will act as a single-turn-shorted secondary of a transformer, the primary of which is the work coil. In such a case the number of ampere turns in the secondary equals those of the primary. The amperes per inch in the secondary will then equal the ampere turns per inch of the primary. Thus for a cylinder in a long coil the watts per square inch into the cylinder's surface is independent of the size—i.e., in a large cylinder the same current flows in a longer path; the larger the diameter, the greater the total heat generated.

If the copper cylinder is heated to 950°F, the only change is an increase in the resistivity of the copper by a factor of three. This increases the depth of penetration and the watts by a factor of the square root of three; thus, there is more heat, generated more uniformly throughout the cylinder. True, as the temperature of a non-magnetic load is increased, both the power into it and the depth of the heated zone increase. This is because the resistivity of metals increases as the temperature rises.

Next consider an iron cylinder at room temperature, the resistivity of which is 4×10^{-6} ohm inches and the permeability of which shall be arbitrarily assumed as 36. (The actual value of the permeability depends upon the intensity of the magnetic field at the surface of the work; it is thus a function of shape, size, and current in the work coil.) The depth of penetration is .4 that of the copper cylinder (i.e., .13 inches).

However, a change of considerable magnitude has occurred for the power into the cylinder. The increased resistance and the permeability have both contributed to increase the power to almost 15 times that of the copper at room temperature. If this iron cylinder is heated to 1300°F, the increase in resistance results in increased depth of penetration and power input by a factor of three.

If the temperature is raised another 150°F, a sudden change occurs; the iron becomes non-magnetic and its permeability drops to unity. This results in increased depth of penetration by a factor of 6 and a corresponding decrease in the power into the work. In the case of all magnetic materials, there occurs quite a sudden change of load as the material passes through the Curie temperature, which is the transformation temperature, above which the material is non-magnetic.

As a final example, consider the depth of penetration for a three inch cylinder of stainless steel, the resistivity of which is 13.5×10^{-6} ohm inches. The depth of penetration for 60 cycle current is 1.5 inches. From Fig. 6 it can be seen that the depth of penetration is so deep that current is far from negligible at its center. The end result is an effective current as shown, and it is obvious that the heating will be reduced considerably below that which was calculated by the formula.

In this case, delta was equal to the radius of the cylinder. The smaller delta is compared to the diameter, but it can still be applied so long as delta remains less than $\frac{1}{3}$ the diameter or, where the material is not cylindrical, provided delta is less than $\frac{1}{3}$ the minimum dimension.

The frequency, which so far has been 60 cycles, also affects the depth of penetration since the formula for delta contains the factor "square root of frequency." Thus, if the frequency is raised to 6000 cycles, the depth of penetration would be decreased by a factor of 10; if the frequency is 600,000 cycles per second, the depth of penetration is $\frac{1}{100}$ of its former value (i.e., it is only .015 inches for the stainless steel cylinder).

So far, discussion has been confined to where heat was generated; now a word about the end result. If a piece of

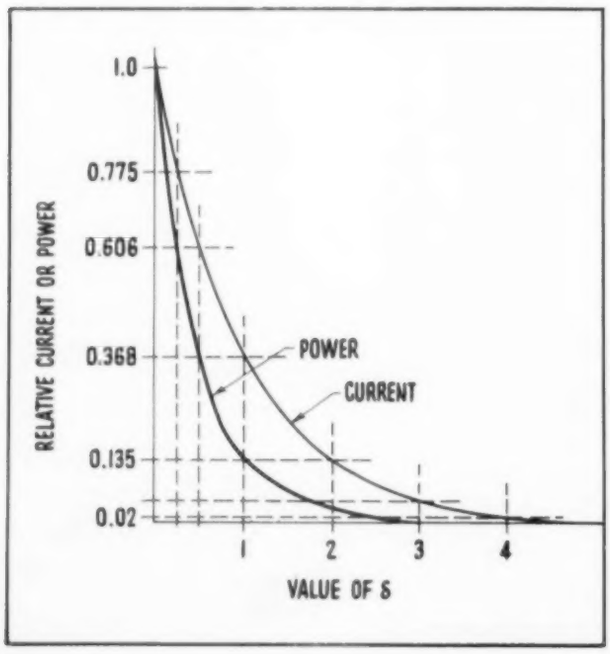


FIG. 3 at left.

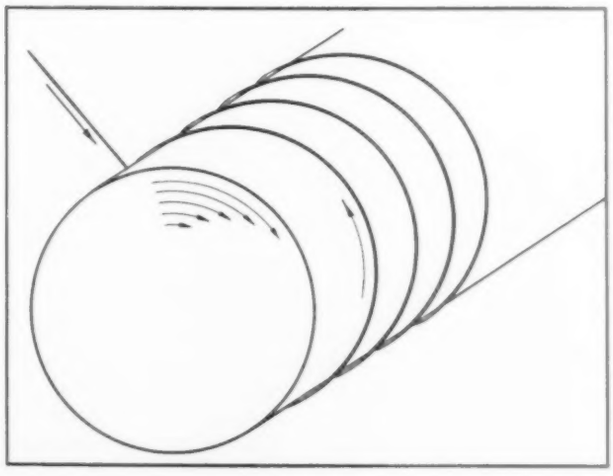


FIG. 4 below.

metal is to be heated throughout its mass, it can be done in two ways: 1st, by high frequency; 2nd, by low frequency. In the first case the heat is generated close to the surface and it takes time for the heat to soak into the interior—a long time if the piece is huge. In the second case, more of the heat will be generated in the deeper sections of the piece—the preferred way.

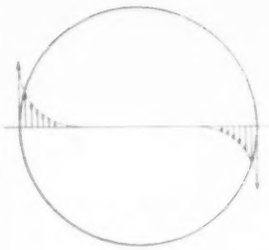
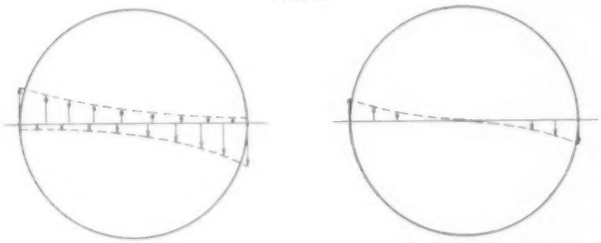


FIG. 5.

When desired to locally heat an area, or to surface harden something, it is convenient to use high frequency to generate heat near the surface, and high power to shorten the time that heat must be applied, for during this time heat is conducted away to the interior of the piece and a thicker layer is being brought up to hardening temperature. In other words, case hardening can be done with high frequency and short time or with very high frequency and a somewhat longer time with lower power input. The question is why not just keep raising the frequency to further localize the heat? This is done up to frequencies of about one million cycles per second. At frequencies above one megacycle technical difficulties arise. Though successful hardening has been done at ten megacycles, one megacycle is generally considered a working maximum for induction heating.

FIG. 6.



Now, a word as to difficulties. So far a cylinder in a long solenoid has been considered. As the frequency is increased, the impedance of the work coil increases and eventually a limit is reached where, even with a minimum of inductance in the work coil, the voltage between turns of the coil or the voltage between the coil and the work becomes large enough to cause arcing. Technical difficulties, arising from an attempt to get the required power into the work without arcing, sets the upper limit of frequency used for induction heating.

From the formula for watts into load, the power increases as the square root of the frequency. Thus, by increasing the frequency, the same heat can be put into the work using fewer turns or less current in the work coil. For example, heating at 600,000 cycles requires $\frac{1}{10}$ the ampere turns required for the same heat input at 60 cycles. This large reduction in ampere turns often greatly simplifies the design of coil used at the high frequencies since with small pieces or for heating local areas, the number of ampere turns that can be coupled to the piece or area is often limited.

High frequency induction heating finds many applications in heating of small metal pieces, and its thin depth of penetration indicates its use for case hardening. Where heavy sections are to be heated or hardened, or where a deep heat penetration is required, low frequency—sometimes even below 60 cycles—is used.

INDUCTION AND DIELECTRIC HEATING DATA SHEETS

PHYSICAL CONSTANTS OF METALS
(20° C Unless Otherwise Specified)

Material	Resistivity Microhms/CC	Temp. Coefficient of Resistance	Specific Gravity	Specific Heat	Coeff. Thermal—Cond.
Aluminum	2.688	.00403	2.70	.214	.5
Barium	9.8	.0033	3.78	.068	
Beryllium	10.1			.397	
Brass	8	.002	8.6	.092	.204
Bronze	17.8	.0005	8.8	.086	
Carbon	3500 at 0°	.0009	3.52	.165	
Calcium	4.59	.00364 (0-600)	1.54	.157	
Chromium	2.6 at 0°		6.92	.11	
Cobalt	9.7	.00658 (0-100)	8.71	.10	
Copper	1.724	.00393	8.89	.0921	.918
Gold	2.44	.0034	19.3	.0312	.7
Graphite	800 at 0°		2.25	.17	
Iron	9.8	.0065 (0-100)	7.8	.107	.161
Iron Cast	79-104		7.03	.118	
Lead	22.0	.0039	11.4	.0306	.083
Magnesium	4.46	.004	1.74	.246	.376
Manganese	5		7.42	.121	
Mercury	95.8	.00089	13.59	.033	.015
Molybdenum	5.08 at 0°	.0047 (0-100)	9.0	.065	.346
Monel Metal	42	.002	8.9		.062
Nickel	7.8	.00537 (20-100)	8.9	.105	.142
Platinum	9.83 at 0°	.003	21.4	.0324	.166
Potassium	6.1 at 0°	.0055 at 0°	.851	.19	
Silver	1.629 at 18	.0038	10.5	.056	1.0
Sodium	4.3 at 0°	.0054	.951	.295	
Steel (Soft)	11.8	.004	7.7	.118	.115
Steel (Hard)	45.6	.0016	7.7	.118	.115
Steel (Nickel)	30-85	.0007	7.7	.118	.115
Tantalum	15.5	.0031	16.6	.036	.130
Thallium	17.6 at 0°	.0040 at 0°	11.86	.038	
Thorium	18	.0021 (20-1800)	11.5	.027	
Tin	11.5	.0042	7.3	.054	.155
Tungsten	5.5	.0047 (0-100)	19	.034	.476
Zinc	5.75 at 0°	.0037	7.1	.093	.265

Data compiled by the Industrial Electronics Div'n, Westinghouse Electric Corp'n, Baltimore, Md.

A Symposium

The Tools and Techniques for the Production of Precision Gears

Installment No. 5, in which the Symposium Concludes with Gear Grinding and the Tools for Checking.

The Grinding of Gears

By Gunnar Skog

It has been claimed, and on good authority, that the grinding of gears is expensive and, considering recently developed (or refined) techniques, largely unnecessary. While advanced by exponents of other methods of gear finishing, which might presume bias, these claims have been conceded, although with reservations, by at least one prominent manufacturer of gear grinding equipment. The reservation is that the matter of expense can now be expressed in past tense.

It is not proposed, in this article, to go into the pros and cons of various methods of gear finishing. With but few exceptions, all that has been adequately covered by other contributors to this Symposium. However, a brief resume, together with a comparison of what may be termed soft finishing and the grinding of hard gears may be in order, as these differences have not been previously discussed in the Symposium.

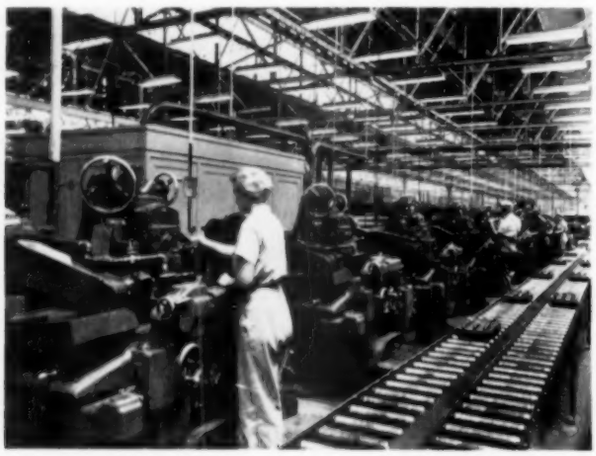


FIG. 1, above, production grinding on a battery of Pratt & Whitney 10" Hydraulic Gear Grinders.

It is true that late developments—as shaving for an example—permit finishing to extremely close limits of tolerance (plus or minus .0002"), and that these techniques compare favorably, in results attained, with gear grinding. They are fast, economical, accurate and applicable to a wide range of gears. But, they are not applicable to the finishing of hardened gears, and only hardened steel gears combine lightness with the qualities of strength and wear resistance necessary to sustained service under severe operating conditions.

To a considerable extent, these techniques depend for success on several factors. These include nearly absolute truth of bores in relation to sides or hub ends; close control of dimensions through the several successive operations, and the use of steel that will not distort unduly as a result of subsequent heat treating, should this be called for.

If left soft, the gears will obviously have to be somewhat heavier than hardened steel gears, to distribute load and wear. But if hardened, they should compare favorably with hardened and ground gears in weight, strength and resistance to wear. And, if the bores and ends are ground, they will be comparably accurate since bore grinding would be gaged from the pitch circle. But it does not follow, due to possible distortion from heat treating, that they would be consistently accurate within the plus or minus .0002" which is conceded the maximum run-out allowed for extreme quietness and smoothness of operation.

However, we are not concerned, here, with the grinding of bores or sides—or hub ends—which may be termed incidental if necessary operations under certain conditions. Rather, we are concerned with the grinding of gear teeth, and the foregoing is merely a case for alternate methods of finishing, each having high merit and each conducive to economical processing.

FIG. 2, below, the P & W 26" Universal Hydraulic Vertical Gear Grinder.

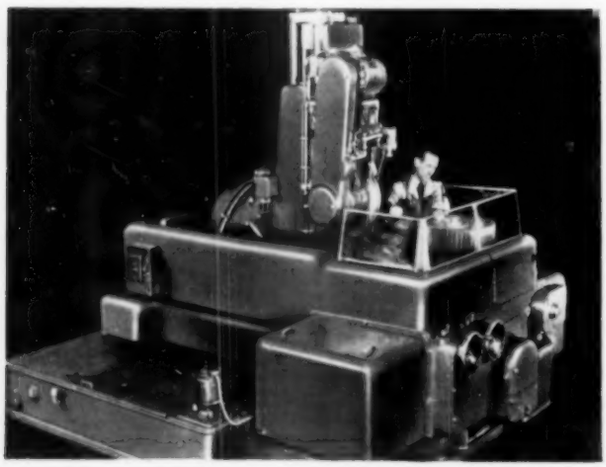
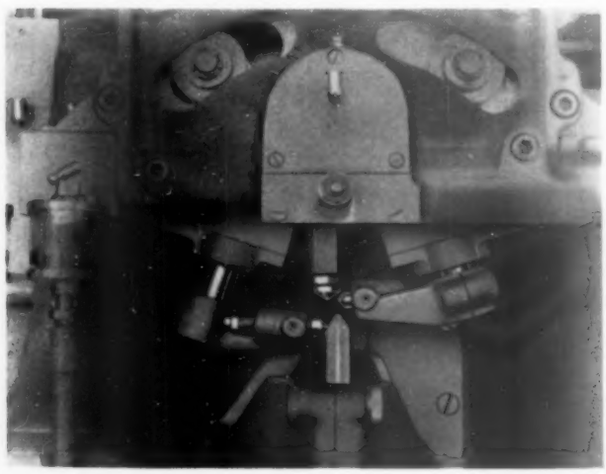


FIG. 3. Detail of wheel truing device, the 10" P & W Hydraulic Gear Grinder.



We have, then, a choice between what may be termed soft finishing of gears, in a very wide range, and the grinding of gears, usually hardened but sometimes soft, in a range that, by comparison, may be termed limited. Actually, however, the grinding of gears is Big Business, while improved techniques have not only broadened the field but have effected economies that quite cancel out the previous objection of expense.

In the grinding of gears, we have in turn a choice of two methods—form grinding and generating. In the first, the teeth are ground by formed wheels, much after the manner of milling with formed cutters. The wheel is shaped to the involute form by means of diamonds (crush dressing is being experimented with) and reciprocated over the work until the required depth of space is attained.

Assuming that the hole and ends are previously ground—as they usually are—and that the gear runs true on the arbor, such grinding results in very high accuracy. However, several wheel dressings may be necessary, especially if there be any marked initial run-out to cause wheel wear; then, the final passes are run out as spark-outs. It is largely on such possible, recurrent wheel dressing that claims of expense are based. If, however, crush dressing should prove feasible for gear grinding—and it may be, by now—then, the cost of form grinding would doubtless be considerably reduced.

While gear tooth grinding may have been a comparatively expensive operation in the past, yet made necessary when high quality rather than initial cost was the main consideration, the objection of expense has been quite cancelled out by the generating process of grinding. Typical of this method is the Pratt & Whitney* line of gear grinding machines, currently made in three styles and two sizes—the 10" single wheel (Fig. 1) and the 10" two wheel hydraulic machine for spur and helical gears, and the 26" universal hydraulic vertical gear grinder (Fig. 2), also designed for spur and helical gears.

In principle, these machines are analogous to the gear shaper, in that—as in the 10" single wheel and the 26" machine—a reciprocating ram carries the wheel to and fro along the teeth. In the case of the single wheel grinder, the adjacent sides of two teeth are generated at once. The wheel is dressed with symmetrically bevelled sides and straight top, the periphery contour corresponding to the straight sided basic rack of the involute system. Dressing is done with three diamonds, as shown in Fig. 3, each individually mounted in a sliding bar but all three actuated by a single lever.

The bars, for dressing the sides of the wheel, are individually adjustable, by vernier, from 13 to 30 degrees by minutes. The third bar, for dressing the O.D., is not adjustable and may be replaced with a radius truing attachment, when desired, for rounding corners of the wheel.

In grinding, one gear—or a stack of gears, as the case may be—is rolled past the reciprocating wheel, and the latter guided by a master gear and rack. Thus, the wheel always engages the gear, tooth for tooth, in exact coordination with the engagement of the master gear and rack. The wheel makes as many passes, per tooth, as are necessary for the finish desired; then, when the work has rolled clear of the wheel, it is automatically indexed. And when all teeth have been ground the machine automatically stops.

The ram, stroke of which is adjustable, is hydraulically operated and has a range, in speed, up to 50 feet per minute. Cushions provide for full speed and reverse without perceptible shock, the design as a whole being ideal for smooth, precision grinding. The table is also hydraulically operated, and has two speed ranges, slow for grinding and fast for indexing. Speed change, from one range to another, is automatic, with slow speed variable for rough and finish grinding. The table moves to the right, under power, for safe clearance when loading and unloading.

*Pratt & Whitney, Division of Niles-Bement-Pond Company, West Hartford, Connecticut.

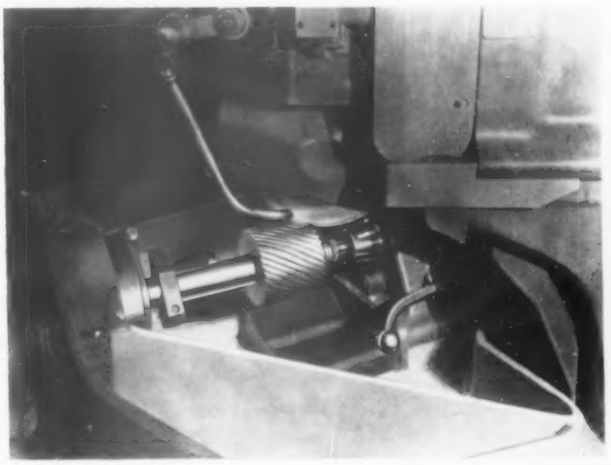


FIG. 5, above, work set-up for helical gear on P & W Single Wheel Gear Grinder.

FIG. 4. Aligning work with the driving dog, on a fixture, for proper engagement with the grinding wheel.

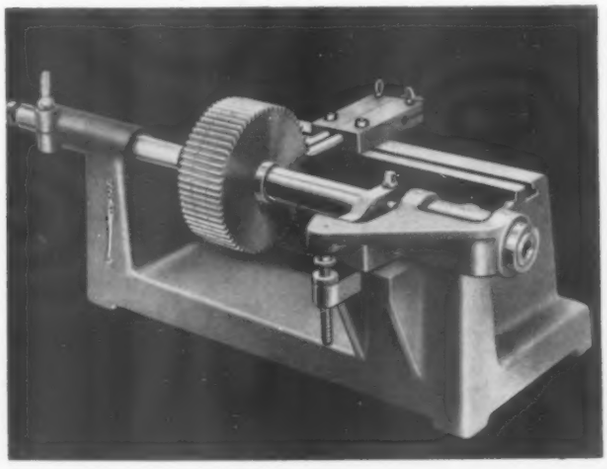
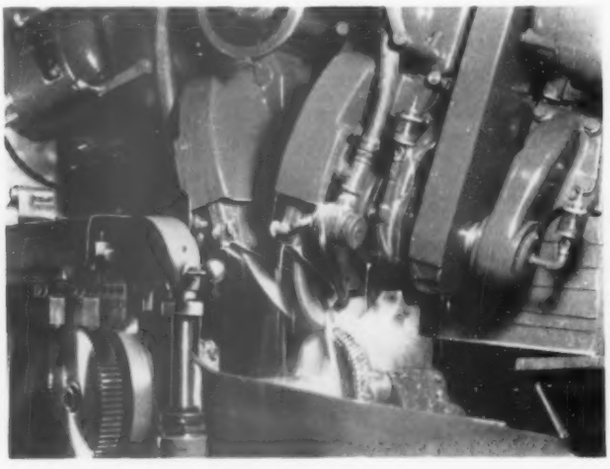


FIG. 6, below, detail of wheel head, the P & W Two Wheel 10" Hydraulic Gear Grinder.



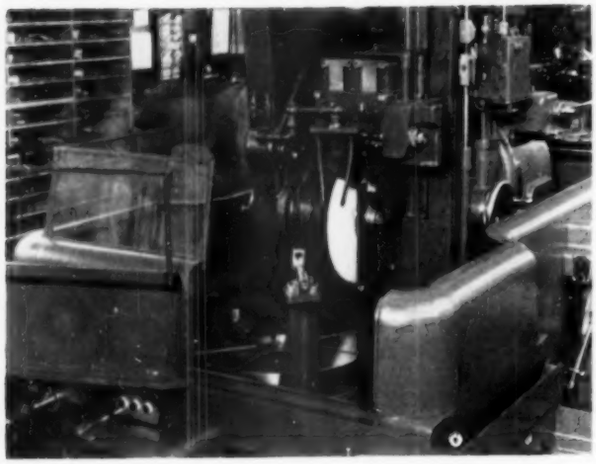


FIG. 9. View of wheel head and truing device, the P & W 26" Vertical Gear Grinder.

It is not the intent, here, to go into detailed description of these machines; however, an outline of their operation seems to be in order if the lay reader is to obtain a grasp of their functions as they apply to the generating of gear teeth. And apparently, the purpose of this Symposium has been severalfold—to acquaint lay readers with the various techniques and thereby broaden the scope of "know-how"; to acquaint manufacturers of gears, rather than of machines, with the latest in equipment, so that maximum economies may be effected; and, to constitute a forum for the "experts," however these may be assumed to know all that is to be known about the subject.**

In gang grinding—and it is in gang grinding that major economies are effected—it is essential that the several gears on the arbor be accurately aligned. This is done in a fixture, shown in Fig. 4, which also aligns the work with the driving dog so that no "jockeying" is required when the work is centered in the machine. That is, once aligned and positioned in the fixture, the ganged assembly will be correctly positioned in the machine and the operator can immediately start grinding.

These machines are equally adaptable to spur and helical gears. See detail of set-up for helical gear, Fig. 5. For spur gears, ram movement is parallel to the axis of the gear, while the work slide moves at right angles to the center line of the gear, the whole a combination of straight line and rotary movement without any "twisting" motion.

In the case of the single wheel gear grinder, as previously stated, the adjacent sides of two teeth are generated at once. In the case of the two wheel machine, of which a detail of the wheel head and truing device is shown in Fig. 6, two large wheels are employed, each of which is capable of grinding the entire working surface of a gear tooth in one pass. However, it is limited to narrow gears although, for such work, its production rate is considerably faster than the single wheel type.

In general construction and principle, the single wheel and two-wheel machines are very much alike, the main difference being in the ram construction and wheel details. In the first, the ram reciprocates; in the second, it is stationary, and the gear, guided by the master gear and rack, rolls past the two wheels. The wheels, being large, cover the entire working surface at one pass, as stated, and index occurs at each reversal of the table.

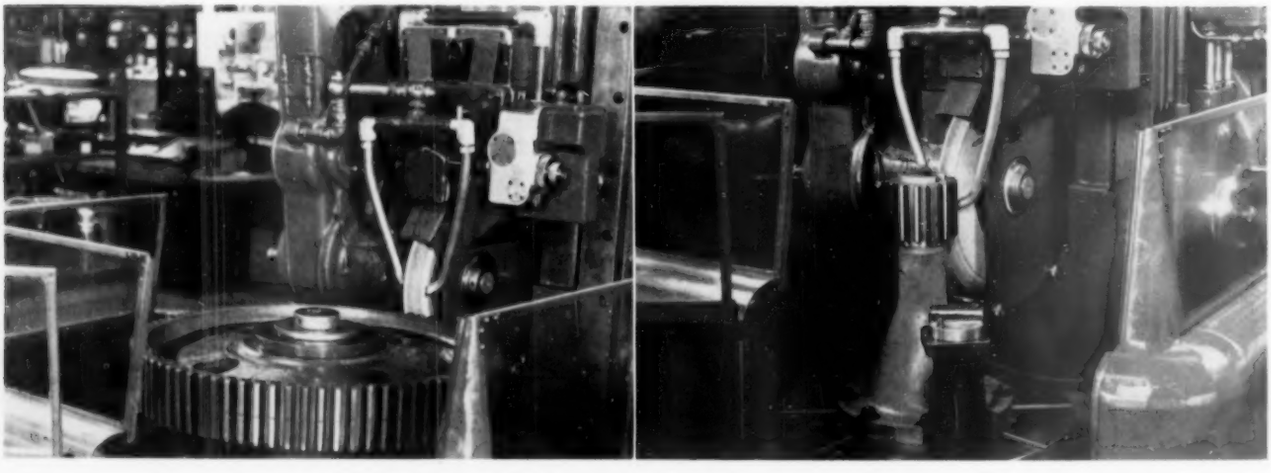
A recent development, by Pratt & Whitney, is the 26" universal hydraulic vertical gear grinder, shown in Fig. 2. This is also designed for spur and helical gears, and will handle gears up to 30 inches O.D. and from a minimum of 12 to a maximum of 2 diametral pitch. It is adaptable to helical gears, right or left hand, up to 35°, with maximum face of 10". Except for a few prime numbers above 83, the machine has an index range from 5 to 190 teeth.

In principle, this machine is similar to the 10" single wheel machine in that both produce involute tooth profiles by rolling the pitch circle, of the gear being ground, upon an imaginary pitch line. This roll is perpendicular to the gear axis, with generating effected by a Vee form grinding wheel, which simulates one tooth of a generating rack. Like the 10" machine, the wheel is mounted on a ram which reciprocates in a line parallel to the axis of the gear. The vertical construction greatly facilitates the handling of large and heavy work.

The main difference, between this and the smaller machine, is that instead of the master rack and master gear system, the vertical employs a system of change gears. The work, mounted on a rotary table supported on a screw-actuated carriage which moves in a line perpendicular to work axis, is rotated by a worm and wheel, and the relative movements of the rotary table and the sliding carriage determine the rolling or generating pitch diameter of the work. The ram reciprocates as in the case of the 10" machine previously described, the only difference being that motion is vertical. Figs. 7 and 8 show details of set-up and general operation.

**Mr. Skog's surmise is correct. To judge by responses, men in all the brackets mentioned have evinced a keen interest in this Symposium.—*Ed.*

FIGS. 7 and 8 (left and right), grinding a large spur gear and a comparatively small pinion on the P & W 26" Vertical Gear Grinder.



Wheel dressing is somewhat similar to that of the 10" machine, in that three diamond dressers are employed. The side diamonds are mounted on a parallelogram linkage, and may be guided in a straight path, for pure involute teeth, or they may follow a partially curved path for tip relieved or modified involute form. They may be set for any pressure angle from 13 to 30 degrees.

Taken as a whole, these machines typify the latest in precision gear grinding equipment, and may be said to effect economies in gear finishing that compare favorably with what may be termed competitive methods. However, the term "competitive" is a misnomer inasmuch as progressive gear plants may employ any or all of the machines and equipment described in this Symposium. Where conventionally processed gears meet all ordinary requirements, they may be considered adequate for the purpose intended. If, however, the ultimate in refinement and accuracy is demanded, then refined methods of gear finishing, as shaving, lapping or grinding is in order.

In any event, there are certain "musts" that must be adhered to, in modern gear manufacture, regardless of the method used. These include careful selection of gear material, rigid control of quality, precision workmanship and progressive inspection and checking from the turning of the blank through to the final operation. Gears have long since graduated from the "cog wheel" class; they now rank among quality products. And a quality product demands quality equipment for its manufacture.

The Tools for Gear Checking

By Anders Jaunson

From the time, a half century or so ago, that cast gears began to be superseded by machine cut gears, inspection equipment has steadily grown in importance and in scope of coverage. As a result, there has been a progressive, year to year refinement until, today, the machines used for gear inspection may truly be termed precision gages embodying practically every modern innovation to be found in the most sensitive of measuring instruments.

In the early stages of evolution, spur gears—as an example—were checked by means of fixed studs mounted on a base. If the gears were too big, they were recut, the depth of recut usually determined by trial although a skilled operator could shrewdly arrive at the amount. On such a fixture,

FIG. 1. Center distance checking machine for spur and helical gears.

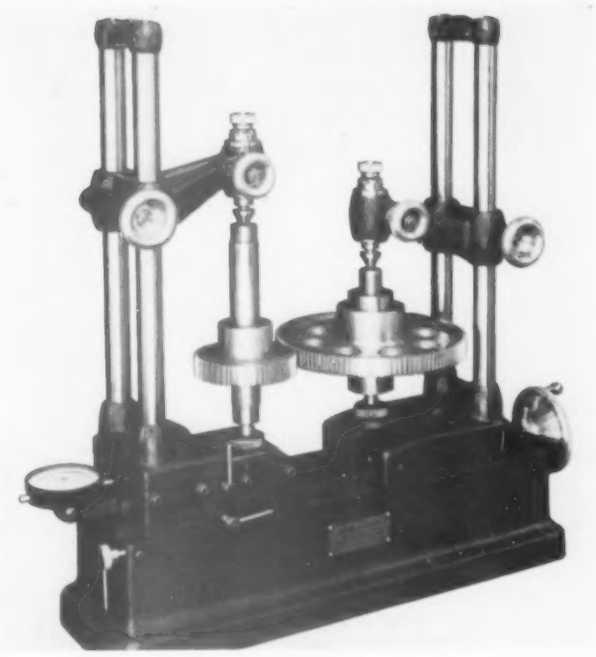


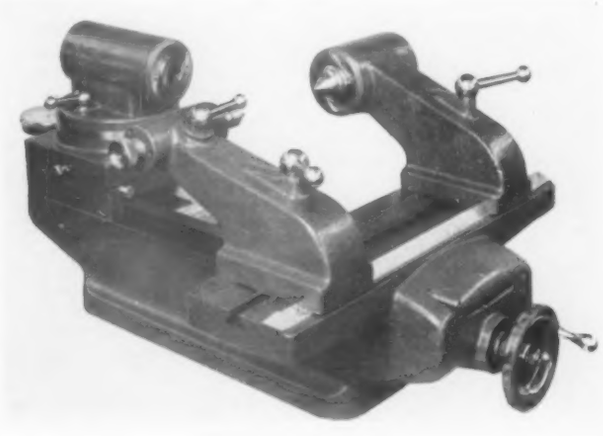
FIG. 2. Hand rolling measuring machine for small, fine pitch gears.

the gears would be "rolled" in pairs with the degree of permissible run-out largely at the discretion of the inspector.

Later, an adjustable center machine was developed, by Brown & Sharpe, which incorporated a vernier scale and which was further provided with slip-on bushings, to fit over the studs. These bushings, the bore of which was a close slip fit on the studs, permitted the testing of gears with various hole sizes. The vernier provided accuracy to .001", with closer reading depending on the eye of the tester. As with the fixed stud fixture, however, checking was largely by feel although there was the advantage that, if oversize, the amount of recut could be determined. These machines were similar to the spur gear checker, shown in Fig. 1 which, with refinements, embodies all of the principles of the original spur gear center distance checker.

Similarly, machines for the roll testing of bevel gears and worm wheels were developed; here, too, inspection was by "feel" and largely a matter of operator discretion. Before the advent of the generating shaper, bevel gears had to be "touched up" with a file as a final operation, and this operation was largely a specialty of the skilled workman. Accuracy there was, but not on a plane comparable to the pre-

FIG. 3. Bevel gear hand rolling fixture used in combination with master gears.



cision standards of this day. Yet, practically every principle on which those early machines were based are embodied in the inspection *tools of today*.

It should not be inferred, from the foregoing, that gear manufacture in the earlier days was haphazard. On the contrary, quality was a paramount consideration. The gear manufacturers jealously guarded their reputations and quality of product was maintained on the highest possible standards consistent with the methods in vogue.

As a testimonial to the accuracy of early machines, the reader is referred to the "Gear-Cutting Engine" shown on page 20 (Fig. 5), January THE TOOL ENGINEER. This machine, made by Brown & Sharpe in 1855—ninety-one years ago!—not only produced accurate gears but extremely accurate index plates and, with the advent of mass production in the automotive field around 1904, transmission and axle gears were manufactured to surprisingly accurate standards. By that time, however, the generating gear shapers—Fellows and Gleason—were in an advanced stage of refinement and gears so generated compared, in manufactured quality, quite favorably with those produced today.

That they fell short in other qualities—as wear and quietness—was due to other conditions. Metallurgy and heat treating had not advanced with mechanical developments, nor had inspection equipment and methods. Consequently, gears might run out, after hardening, despite careful grinding gaged from the pitch circles, and teeth would wear as a result of clashing—as in gear shifting—or, they would break as a result of transmission shocks. But, all things considered, they were good gears nevertheless.

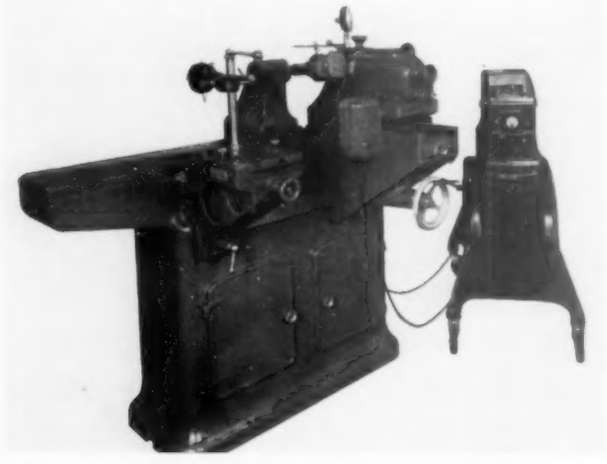
All this was well expressed by George T. Christopher, President and General Manager of the Packard Motor Car Co., in his address at the A.S.T.E. banquet during the recent New Era Exposition in Cleveland. He said, among other things:

"For years, designing engineers knew how to design better gears than we had equipment or materials to produce. When we got equipment and materials to produce what they had specified, they put us right back where we were before—by specifying, between finishes, more accuracy of tooth spacing, better control on the surface hardness, and a more uniform depth of supporting hardness! To make sure that the constant of difficulties of producing to specifications was continued, some keen, progressive commercial tool and gauge manufacturers came along with equipment that would check these requirements of the specifications."

The foregoing history, in outline, is given so that the reader may have a clearer concept of subsequent refinement, and especially of development in the inspection and testing fields. In this connection, it should be considered that manu-

FIG. 4, left. Involute profile measuring machine with electrical recorder. Recorder head shown at left of gear.

FIG. 5. Base pitch and space measuring machine for spur and helical gears.



Throughout this Symposium, which concludes with this issue of *The Tool Engineer*, every reasonable effort has been made to avoid duplication. Naturally, however, a certain overlapping was to be expected, especially in view of the scope of subject matter and the many contributing authors.

We are not particularly perturbed over such overlapping, where it occurs. For, we have found that our readers demand the fullest coverage on any subject presented, and this applies especially to tools. They want to know what equipment is used for any particular process, how it is used and where it can be obtained.

In line with this demand, we present an article—*The Tools for Gear Checking*—by Anders Jansson, which deals principally with gear testing and checking equipment manufactured by Illinois Tool Works, Chicago. This article may be termed a sequel to the article on "Gear Inspection," by A. D. F. Moncrieff in April *The Tool Engineer*.

Together with Mr. Moncrieff's contribution, in which he discussed inspection equipment manufactured by Michigan Tool Company, Detroit, and testing equipment previously described—as by Fellows, Gleason and others—this article just about "covers the waterfront" on the tools for gear checking. That is, with the exception of optical testing equipment and lantern projection, which, for good reasons, will not be treated in this series.

In concluding, we express sincere appreciation to all who, directly or indirectly, have contributed to this Symposium. In some instances, contributors were constrained as a result of industrial disturbances that, to put it mildly, placed an inordinate burden on engineering personnel. Yet, for all concerned, there is the satisfaction of having contributed materially to the sum total of knowledge in the art of gear manufacture.

Andrew E. Rylander

Technical Editor

facturers of gear manufacturing equipment—as Brown & Sharpe, Fellows, Gleason, Gould & Eberhardt, Barber-Coleman and others—also manufactured gears, and several of these companies also developed testing equipment, not only to meet their individual needs, but the needs of the gear industry as a whole. Later, Michigan Tool Company, Detroit, and Illinois Tool Works, Chicago, took up the development and manufacture of gear checking equipment and, to a considerable extent, made such manufacture a specialty.

Actually, the latter concern started to develop and manufacture gear testing tools, some thirty-four years ago, to fill a need for inspection equipment that would not only accurately check center distances and tooth profiles, but tooth to tooth variations—the latter a vital consideration for quiet running.

The inspection and checking tools produced by Illinois Tool Works include variable-center machines for checking center distances of spur and helical gears, hand rolling fixtures for bevel gears, machines for involute profile checking and for normal pitch and space inspection, and so on through a wide range including electric recorders and fixtures for checking hobs, formed cutters and gear shaper tools.

Taking these in turn, Fig. 1 shows a center distance checking machine, for spur and parallel axis helical gears. This machine, which is similar in principle to the spur gear checker previously mentioned, is equipped with a vernier scale, with finer readings—to .0001"—provided by a dial indicator. The latter is actuated by a floating unit in the headstock (at left in photo) which, when unclamped, shows whether or not mating gears, under test, are plus, minus or correct to specifications.

By "jumping," tooth for tooth, and then rolling the gears by hand, any error in tooth spacing or tooth profile can be noted on the dial indicator. However, maximum accuracy is attained by use of master gears which may also serve as norms for center distance. Range of this machine is from $2\frac{1}{2}$" to 20".

FIG. 6. Helical lead measuring machine for checking helices.

FIG. 7. Gear charting machine for producing charts that show combined errors in spur and helical gears.

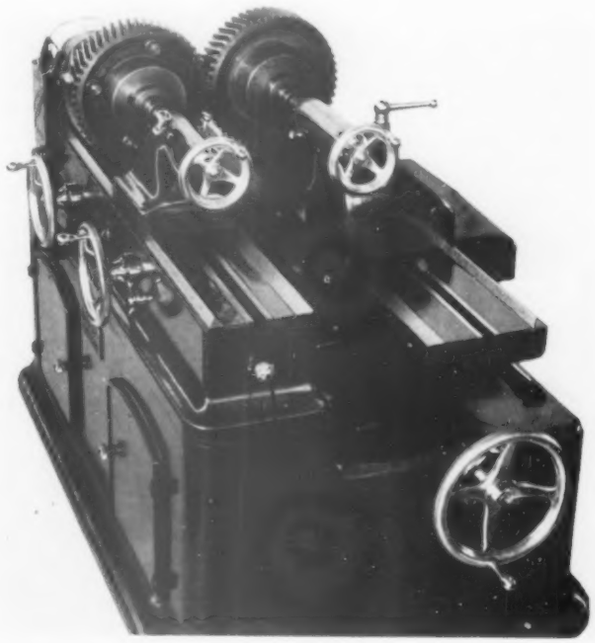


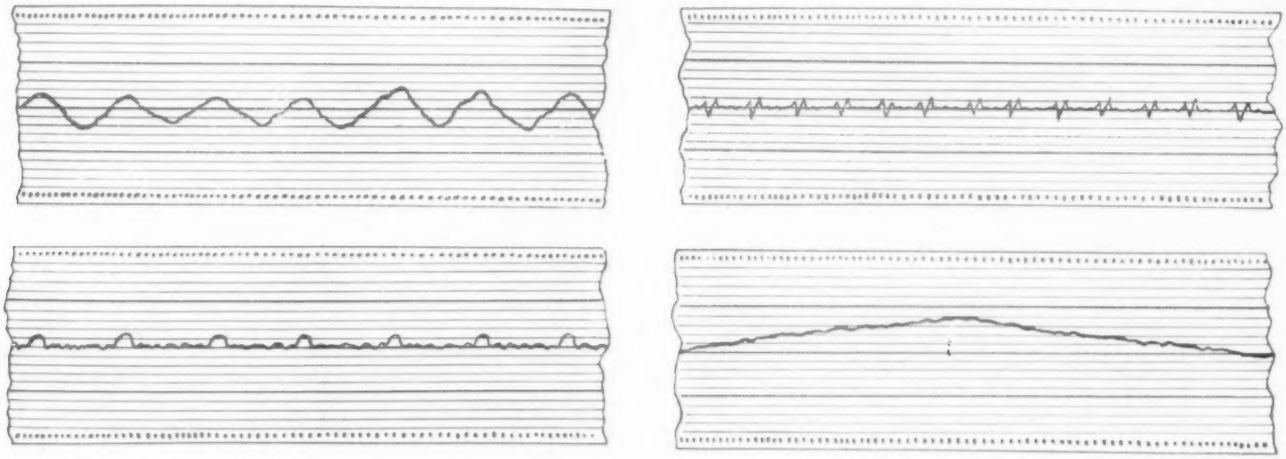
FIG. 8. Typical charts produced on gear charting machine, Fig. 7.

A (top) shows regular curves, one for each tooth in the gear indicating incorrect pressure angle.

B (below). Humps at regular intervals would indicate uneven tooth spacing. Occasional humps would indicate multilated teeth, foreign particles, or chips.

C (top). Partly smooth and sudden waves in the line for each tooth contact indicates interference or too much tip relief on gear teeth.

D (bottom). A long curved line indicates eccentricity—each space equals .001".



Another machine, embodying similar principles but designed for fine pitch gears, spur and helical on parallel axes, is shown in Fig. 2. Like the machine shown in Fig. 1, it is provided with a dial indicator and will check gears for variation in eccentricity, pitch diameter and center distances within plus or minus .0001". By resort to offset studs, the minimum center distance, attainable with this machine, is $^3/_8$". Maximum, with regular studs, is 8".

It may be of interest, here, that there is no practically certain way, at this stage of development, to check very fine pitch gears with tooth calipers, although projecting (optical) comparators have latterly been refined to a point where very fine tooth profiles may be accurately checked. To meet exact specifications, therefore, it is necessary to hob or otherwise cut two gears on an arbor at the same time (the pairs will then be alike) and then to test them for center distance. If over or undersize, another or even several pairs may have to be cut until exact dimensions are attained, when the pair so finished will serve as masters for subsequent gears. This applies to both mechanical and optical checking for fine pitch gears.

Yet another hand rolling machine—or fixture—similar in principle but applicable to bevel gears, is shown in Fig. 3. Previously to the development of this type of checker, rolling tests for bevel gears had been done on fixed center fixtures on which work gears were checked, under brake load, to determine tooth bearings and pitch cone angles. Such checking would show misalignment of teeth, for if off center, bearing would show kitty-corner on opposed flanks, at heel and toe. The gears would then be "doctored," as previously described, using prussian blue through several tests until full bearing and free roll was attained. With this fixture, one could also determine the amount of backlash by braking one gear and taking dial indicator readings on the amount of backlash on the mate.

However, fixed center fixtures have definite limitations although, when provided with float and a precision dial indicator, they may be used as final inspection gages. Obviously, they are not flexible and are therefore unsuited to the variety of gears ordinarily produced in jobbing shops. Here, the need is for universal checking tools, whereas fixed center tools have to be designed and constructed for each pair or set of gears.

The fixture shown (Fig. 3) is designed to show jump per tooth, eccentricity, tooth bearings and alignment—that is, the centering of bevel gear teeth at one focal point. In addition, a swivelling head permits settings to cone angles at variance with right angle mating. This is facilitated by use of pitch cone masters, which are exact duplicates of the theoretical pitch and back cone angles of the gears to be tested.

We now come to more involved tools, for gear checking, as typified by the involute profile measuring machine shown in Fig. 4. In this connection, one of the most important elements, in the involute system, is the involute form of the gear tooth itself. And this form is subject to distortion from various causes, as torsional strains set up when cutting but, more commonly, as a result of improperly sharpened cutters.

The function of the machine described is to determine both the nature and the amount of error, to the end that corrections can be made. The machine will check profile errors in the general run of gears for machinery, automotive vehicles and aircraft, as well as cluster gears and gears integral with the shaft, both spur and helical. In addition, shaper cutters may be held, on shoulder arbors, and checked for profile truth. As with the previous machines described, checks may be made within plus or minus .0001".

Also of vital importance—in fact, the most important of all gear elements—is the normal pitch of a gear. Because, this is not only the index to gear performance, but the accepted standard for quietness in gears. To make this clear, it should be understood that, in the involute system, the normal pitch is the distance between adjacent teeth on the line of pressure upon which mating action occurs. Therefore, gears that measure alike on the normal pitch will run

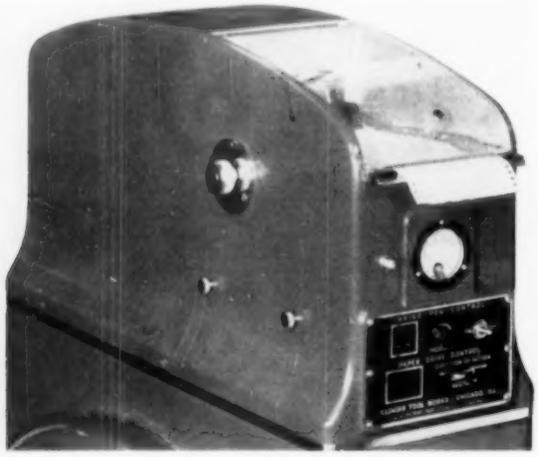
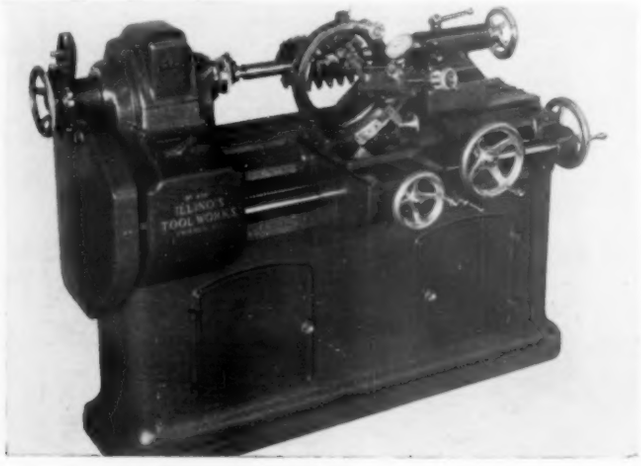


FIG. 9. Detail of Electrical Recorder. See Fig. 4 for complete picture of this unit.

FIG. 10. Worm and worm gear measuring machine. Floating unit carries the worm gear on a stud arbor.

FIG. 11. Universal Hob and worm checking machine, for checking all essential elements of worms and hobs.



smoothly and quietly regardless of their diameter or the center distance between mating gears. This applies equally to spur, helical, bevel and worm gears.

Checking, for normal pitch and tooth spacing, is performed on the machine illustrated in Fig. 5, and is done by means of two fingers, which transfer errors to a dial indicator, moving either along the curved profile of a gear tooth, or the straight sided tooth of a rack. All variations between adjacent teeth are thereby accurately determined.

It is generally conceded that helical gears are not only quieter than spur gears but that they have a certain advantage in strength. There is the further difference that, where spur gears transmit motion by means of the tooth curve, helical gears operate through the pitch helix with the tooth curve itself a secondary consideration.

This does not mean that tooth curve is not important, but that the helix angles of mating gears must exactly correspond if the gears are to function efficiently. For example, if the angles should vary, then mating gears may contact on one end only, with resultant damaging strains to the teeth.

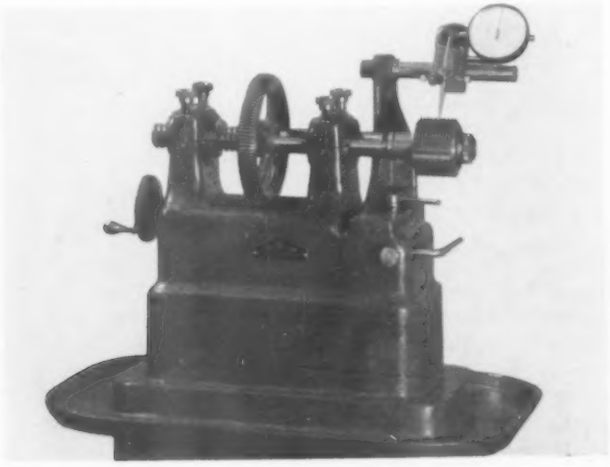
The machine shown in Fig. 6 was designed to accurately check helix angles, and will take gears up to 12" diameter and 15" between centers. It will check helix angles from zero to 90 degrees. All work is held between centers, with the requisite that, where narrow gears are to be tested, they are supported by side plates to avoid side wobble.

So far, nothing has been said, in this article, about permanent recording of checks on gears. The gear charting machine shown in Fig. 7 is designed to chart, mechanically and automatically, the combined errors of tooth profile, spacing, interference and eccentricity. Equally important is the fact that errors can be individually separated and analyzed, as shown in the four typical charts, A, B, C and D, Fig. 8. The captions describe the error shown on each chart.

In connection with this permanent recording is the electrical recording system, which is composed of two distinct members. One—the head—is attached to the measuring machine and is actuated by the movement of the dial indicator. It can be seen, mounted, just to the left of the gear being tested on the machine in Fig. 4.

The other member is the recorder, which is a separate unit mounted on a castered cabinet base. It is shown beside the machines in Figs. 4 and 5, and in detail (without the base) in Fig. 9. In operation, the slightest movement of the dial indicator contact finger registers in the head, and is amplified, in the recorder, to compel movement of the inking pen. Thus, when the finger moves .0005", the inking pen moves .200"—or two spaces on the chart paper.

FIG. 12. Hob lead measuring machine for checking accuracy of hobs after grinding.



Length measurements may be read from the cross lines on the chart paper, which equal one degree of arc. When used for linear measurement, each cross line equals .200" in linear distance. All motions are exactly synchronized by means of synchronous motors, and the resultant chart is a true picture, greatly magnified, of the several errors that may occur in a gear under test.

Another machine, shown in Fig. 10, is designed for checking errors in worms and worm gears for jump, tooth bearing, runout and center distance. It consists of a headstock and tailstock, for holding the worm in a horizontal position, but so arranged that the worm axis may be tilted 5 degrees either way. Vertical adjustment, up to 3", is provided for alignment of worm and wheel.

In connection with worm gears, several machines—as shown in Figs. 11 and 12—are designed for checking worms and hobs. Fig. 11 shows a universal hob and worm checking machine and operates on a very ingenious principle. As will be seen in the photograph, the measuring head turns in a ring, provided with a vernier scale, and will accurately check angles up to 30 degrees—or 60° included angle—and leads up to 150 inches. A machine for measuring hob leads and hob tooth profiles is shown in Fig. 12.

To produce accurate gears, it is also necessary to have accurate cutters, and machines are also provided to check the tools. Cutter sharpener testers, for hobs and formed cutters, are shown in Figs. 13 and 14, while a checker for gear shaper cutters is shown in Fig. 15.

FIG. 13 (left) and 14 (right). Machine and fixture for testing sharpened hobs and cutters.

FIG. 15. Gear shaper cutter sharpening inspection fixture.

By Fred M. Burt

Mass Production of Cast Iron Enamelware

A Sequel to the Article on "Mass Production of Enamelware", in April Issue, "The Tool Engineer". Here, the Author Deals with Enameling of Cast Iron Ware.

This article on modern layouts, equipments, procedures and materials employed in efficient production of cast iron porcelain enameled products, such as bath tubs, sinks and other "sanitarywares," is based on research work, done by the writer, to determine what might be employed to build and operate an ideal postwar enamel plant for cast iron.

This plant described is designed to produce from 50 to 70 tons of completed products per operating day. It is a one-story unit, 705 ft. long and 300 ft. wide and, with mezzanines, has adequate over-capacity for reasonable extra production requirements. It also has stand-by units to prevent production bottlenecks when maintenance and repair work takes others out of production. The layout (see drawing Fig. 1) lends itself to considerable expansion in production capacity, without disrupting production.

***Mr. Burt* is broadly experienced in Porcelain Enameling. In addition to modernization work in this country, he has built a complete plant in Sydney, Australia. The material for this article (as for the one preceding) is largely based on several years of research to determine what might be employed to build an ideal postwar enamel plant from the making of castings through to final inspection.**

A saw-tooth building, with supporting columns 30 ft. apart each way and 28 feet high allows 20 ft. to the craneways with eight feet above that. This provides ample space for the mezzanines. Walls should be of galvanized corrugated iron sheets—or better yet, porcelain enamel—for warmer climates, or brick where it gets quite cold, with an absolute minimum of inflammable materials, for any kind of construction, to cut down insurance rates without using sprinkler systems. Partitions, around all enameling operations and the compressor room, should be dust-tight to exclude dust particles that might come from the foundry and sandblasts.

Good Lighting Essential

For this sort of production, window spaces in walls and saw teeth should be of as great an area as possible, with the glass set in metal frames and easily opened for maximum light and ventilation. Additional light, preferably using 3-tube continuous trough fluorescent units, should provide a minimum of 30 foot-candle intensity at all working planes. In some special spots, such as at the enameling furnaces, it should be at least 50 foot-candles, plus special spotlights to bring it up to 70 foot-candles.

A five-inch concrete floor throughout has the top one inch of special wearing finish, with all heavy trucking areas having recommended quantities of metallic hardener troweled in. All of these building facilities provides the means to maintain a clean, well-lit foundry and a high standard of plant "good housekeeping" throughout. These factors are essential to eliminate hazards of ware defects.

Every item of equipment should be entered on its *Equipment Record Card*, with its *machine number* and all other pertinent data which may be required in the future. All rooms, bays and doorways should have identifying code numbers, and each roof-supporting column should be marked with a location identification. A recommended system uses one corner of the building as the key corner; then, every column is labeled by its distances from the sides and ends of the building converging on that corner. If, for example, the northwest should be the key corner and a column is 90 ft. south of the north side of the building and 60 ft. east of the west side, it would be marked 90s/60e.

Foundry Practice

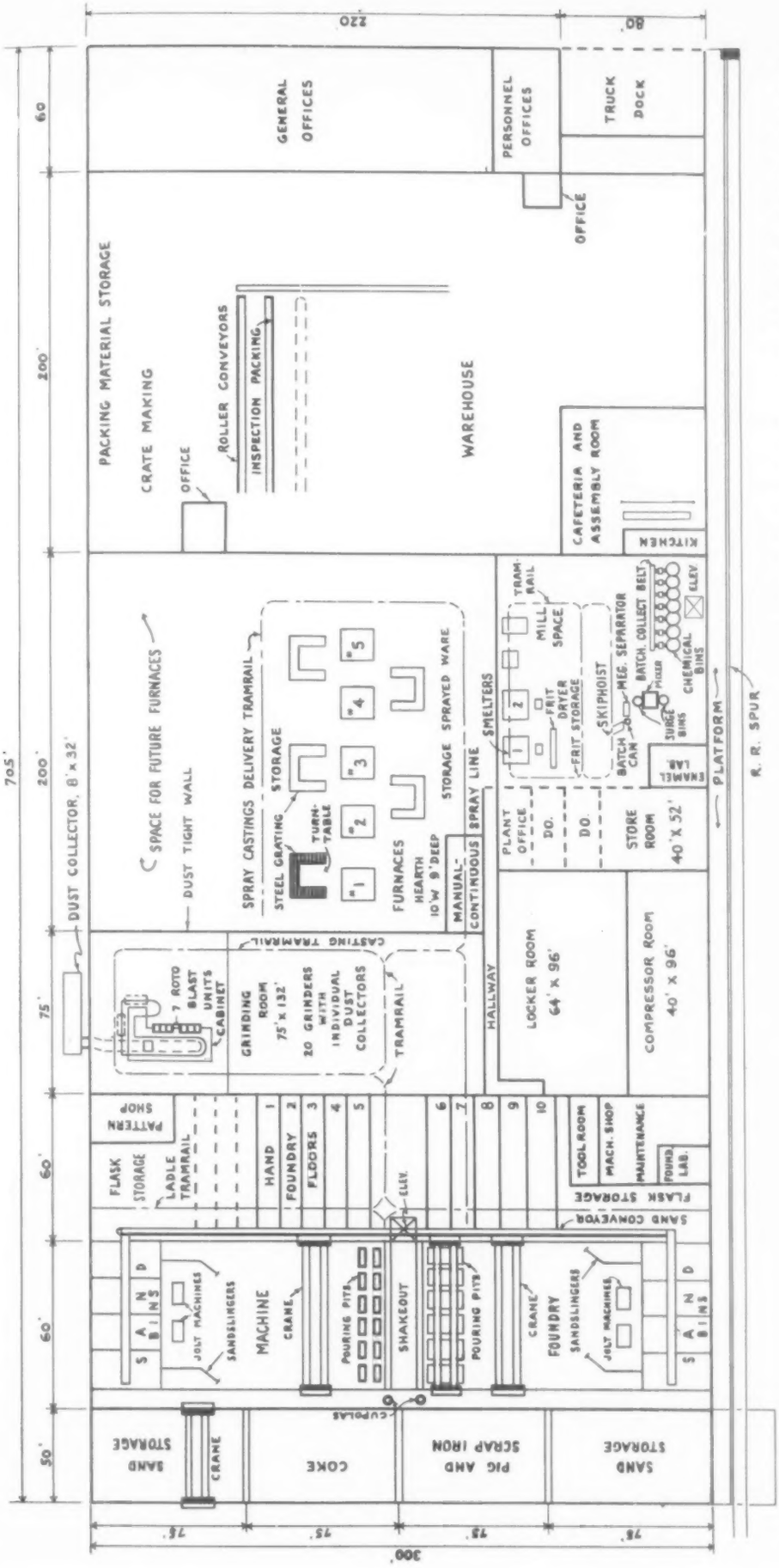
The five-ton crane that runs over the storage bins for sand, pig iron, scrap and coke, keeps the bins filled from incoming freight cars and trucks; also, it picks up loads of iron and coke for cupola charging. On the side of the two 48 in. cupolas (used on alternate days to allow for clean-out and re-line as needed), next to the bins, a track carries a movable scale. Placed in front of the cupola when in use, it weighs the charges in the crane-carried, steel dump-buckets. Small auxiliary bins, at the cupolas, come into use in making small additions or deletions to assure proper weights of charges.

Iron, from a tapped cupola, runs under a dam extending almost to the bottom of the spout, and into a well-insulated mixing ladle. The slag flows over a bridge at one side of the spout, then, accompanied by a small stream of water, falls into a steel container. The mixing ladle assures a homogeneity of iron, also, holds it to the proper temperature until it is transferred to the pouring ladles for both machine and hand floors. The temperature of the iron, as poured, is checked with an optical pyrometer.

The machine foundry is divided, by the "shakeout," into two identical production units, and these in turn are subdivided into two like units. Each of the latter is composed of a jolt machine-rollover combination for drags, and a sand slinger for copes. Above and in back of each of these machines is a sand bin with sand conditioned for use.

In the molding of a tub, the matchplate—with affixed pattern and drag—is placed on the jolt machine and, as the sand is poured, it is vibrated into a solid pack. Then, with the rollover, the position allows the matchplate to be pulled out and set aside for the next tub. At the same time, next to the jolt machine, its companion sand slinger is ramming the cope. With both operations completed (simultaneously when possible) the crane places the cope on the drag. They are then clamped together and transported to a pouring pit.

After the casting is poured, and while still very hot, the shakeout crane lifts it on to the shakeout where the drag, cope and casting are all separated, with all of the sand being vibrated loose to drop down through the shakeout grating. The sand then starts on its course of re-conditioning and return for re-use, travelling over a long magnetic separator for removal of metallic particles. Then it is elevated via bucket conveyor to be run through screens for aerating and cleaning. Finally, it travels on one of the long, rubber belt conveyors to be dropped into the sand bin needing replenishing. Castings are hung on monorail carriers for transport to the blast cleaning room.



Hand floors, for smaller and special castings, are served from the same cupolas and mixing ladle. Pouring ladles travel on the ladle rail, and then out over each floor on rail extensions. Sand from the machine floor is delivered by side dump, bucket trucks. There are alternative methods, often just as efficient but, on a good cement floor, considerable truck handling of lighter units provides greater flexibility. With all pouring done during an 8 hour day shift, a night crew can handle most of the hand floor shakeout work and otherwise prepare for the next day's work.

In the well-equipped foundry laboratory, tests are continually made of sand samples to determine moisture content, permeability, grain size and strength. Analyses are made of raw materials, and samples of metal from each ladle are tested. The fully equipped machine shop, tool room, maintenance department and pattern shop are strategically located for convenience in performing their functions as needed.

Blast Cleaning

When the castings are delivered to the blast cleaning room, by overhead rail, they are run through the airless blast, continuous cleaning system, without allowing any pile-up of uncleaned units. The operations herein described are patterned after, and illustrated by, a very efficient and late Pangborn installation. It carries an endless line of work hangers, suspended from an overhead line and joined together at the bottom. (See photo Figs. 2 and 3.) Each hanger has a hook arrangement that will carry one tub or as many as nine sinks. The delivery rail transports castings to the loading area or where there is space for temporary storage.

After the castings (covered with burnt sand) are placed on the proper hooks, they travel about 130 ft. past seven airless blast units, with each hook-load rotating slowly as it passes them. With a capacity of 140,000 lbs. of steel abrasive flowing through the blasts each hour, the castings come out thoroughly cleaned in one pass. The cleaning capacity is from 100 to 125 hook-loads per hour. Comparative cost figures indicate that the airless units show a saving of from 40% to 60% over compressed air methods.

FIG. 1. Plant layout adaptable to expansion.

The three-part companion system of dust control consists of exhaust hoods, piping systems and dust collectors. Dust-laden air is collected, from the operations, by the piping system, and conveyed to the back of the collector where it hits baffle plates, causing the heavy dust to drop into hoppers. (See photo, Fig. 4.) Air passes on to the screens to deposit the rest of the dust on the cloth, and the filtered air, after passing to the clean side of the cloth, is so pure that it can be circulated back into the plant.

Filter cloths, in the form of bags, are mounted on narrow wire frames with two edges and with one end closed. Filtered air passes into this narrow inner space after depositing its dust on the outside, then passes into the collecting ducts. A rapping device on the inside of the framework, oscillating alternately outward against both wire sides, loosens the dust.

Handling Is Flexible

Cleaned castings, unloaded from the blast line, are then carried by another monorail line to grinders, where they are smoothed down and otherwise put in condition for slush coating with enamel. For this operation, each casting is hung on a monorail carrier hook on the line running into the slush coat booth. The hook is swiveled so that the castings can be revolved for handy spray-coating. This spray room, 20 ft. long, has double, water-wash booths on each side so that, if need arises, two crews can work. But, this is not likely to be necessary.

From the spray room, the coated castings are pushed along the line for storage properly convenient to the furnaces, or, they are transferred to floor storage cradles. The five furnaces are in staggered position to provide more comfortable working conditions. With a working hearth area 10 ft. wide and 9 ft. deep, each furnace has a capacity of two tubs, eight lavatories, or six sinks of average size. Each can produce (with two-man crews on each of four 6-hr. daily shifts) up to 4 tubs, 16 lavatories or 12 sinks hourly. One tub is pre-heating while the other, already pre-heated, is in the air-table.

This air-table—a complicated mechanism—is on an axis mounted over a shallow pit, conveying a form attached to a holder. The form fits the bottom of the tub, embracing and holding it firmly through screw pressure on the apron. Motor operated, the holder circles in either direction on the horizontal plane while the similarly operated axis swings down in either direction. These movements, controlled by adjacent foot-levers, place the tub in all positions necessary for evenly sifting on of powdered cover coat enamels.

Enamels are applied by dredges mounted on the ends of long pipes, containing air lines, with convenient shut-off and an air-hammer mounted next to the dredge. The light, even pounding of the hammer causes the enamel to sift evenly through the finely-meshed wire dredge sieve. Dredges are filled, quickly and automatically, by inserting in a "powder monkey," made of sheet steel, with a sloping bottom, that generally contains enough enamel for at least two or three hours use. When the dredge is inserted in the open, bottom compartment, it trips a release which allows a graduated flow of powder until the dredge is filled. Its withdrawal stops the flow.

As the enamel is sifted onto the red hot tub (or other unit) by the enameler, it starts melting. When enough enamel has been evenly and expertly applied by the enameler and his helper, in synchronized operation, until the melting action has been overcome by the enamel thickness, the unit is returned to the furnace where at approximately 1600-1700 degrees heat, it fuses out smoothly.

In the meantime, another tub is withdrawn and similarly treated. This is continued until the practiced eye of the enameler determines that the tub is properly coated, generally with two cover coats. Handling in and out of the furnace is by means of a large fork thrust under the projecting edges of the tub and from one end. The fork handle is suspended, by chain and hand hoist, from a jib crane mounted at the corner of the furnace.

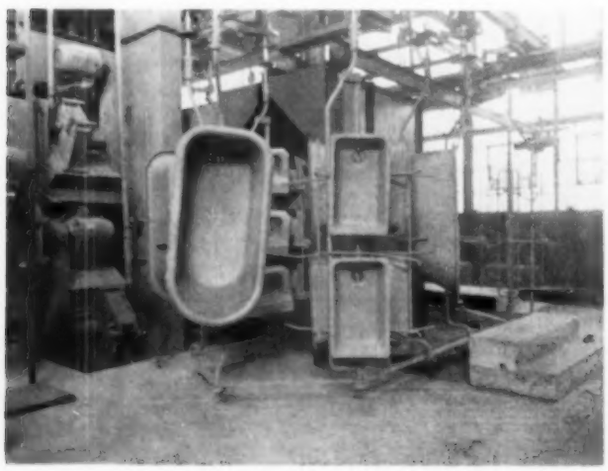
"Good Housekeeping" Predominates

The suspension provides good leverage for lifting. As the door is automatically raised by a foot controlled, power hoist, the tub is lifted and moved into the furnace to be rested on "ware bucks"—i.e., parallel holders. Before the door is closed, the other tub is picked up and brought out. Whenever a tub is completed it is replaced by another slush-coated tub. Smaller castings follow about the same general procedure, but with smaller forks and air-table holders.

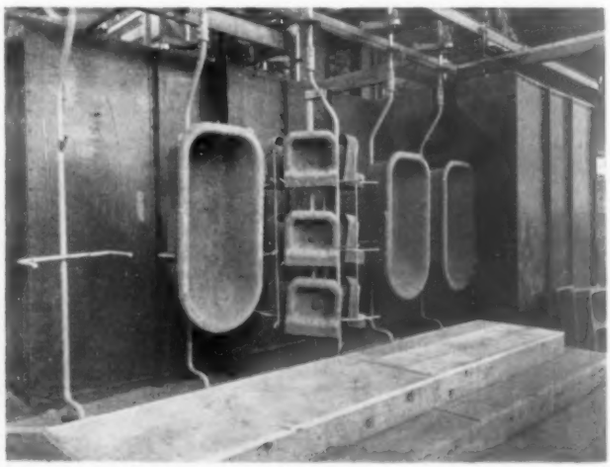
All parts of the air-table should be hooded with porcelain-enameled sheets, with enameled pans in the bottom pit to catch residue enamel and keep it clean for re-smelting. A canopy, over the area in front of the furnace, has a fan to draw off hot air and dust particles. A floor grille, around three sides of the air-table pit, with good, downdraft suction, provides more comfortable and cleaner working conditions.

Furnaces are gas or oil-fired, using full muffles of special refractories. If electrically heated they do not require muffles. They operate under close, automatic, recorder, pyrometric control.

Cleaned tubs and sinks approaching unloading station. Note 6 sinks on one hook. Photo by courtesy of Pangborn Corp'n, Hagerstown, Md.



The loading station, showing tubs and sinks covered with burnt sand, moving into the Roto blast cabinet. Photo by courtesy of Pangborn Corp'n.



The following outline of enamel preparation is similar to a very efficient one adapted by The Toledo Scale Company from one of their glass plant installations. Raw materials are lifted by elevator to a mezzanine above a row of silo-type storage bins holding all of the chemicals in large quantities. (See typical formulas, below.) Beneath the bins, in a small gallery running 8 ft. below, are scales, feeders, hoppers and collecting conveyors at floor level.

Automatic Control of Mix

Bin discharge openings are connected to Jeffrey-Traylor vibration feeders which discharge the required amounts of chemicals into weight hoppers equipped with Toledo dial scales. Flow cut-off is automatically controlled from a central panel. After proper charging, the contents of the hoppers are discharged onto a 24 inch wide, rubber-faced belt running at about 150 ft. per minute. Its load is discharged so that it is picked up by a cupped, belt conveyor, for emptying into a surge bin. This is equipped with a discharge gate, operated by an air cylinder controlled by a solenoid valve. When the surge bin has accumulated the whole batch, the gate is opened and the batch is dropped, via feed pipe, to a 50 cr. ft. capacity Ransome mixer, below.

On the mezzanine, over the silo bins, the less used chemicals are stored either in small bins or in original containers. There are also small scales for hand-weighing. While operating the other mechanisms from the central control panel, the operator (also in this position) can weigh out these light chemicals for discharge through a funnel leading to the mixer feed-pipe.

These are two very good, dry process cast iron cover coat enamels, used in quantity production for white and base for colors. B-54 is a wide firing range and very opaque, non-acid resistant enamel. B-116 AR is one of the most highly acid resistant white and color enamels in use today. 20% HCl placed in a container coated with this enamel leaves no mark or loss of gloss.

Chemical	*B-54*	*B-116*
Borax	24.50	——
Feldspar	33.50	.97
Soldium Antimonate	11.00	11.21
Zinc Oxide	7.00	——
Fluorspar	5.50	2.42
Nitrate of Soda	4.50	2.92
Barium Carbonate	7.00	——
Litharge	7.00	22.43
Boric Acid	——	5.36
Titanium Oxide	——	2.92
Solium Silicate	——	51.70
Total	100.00	99.93

Mixing, at about 10 rpm, is quick and thorough. Then, the batch is discharged into surge bin No. 2, from which it is slowly fed onto a magnetic separator belt, to pull out metallic elements, next, down a "pants-leg" chute into a bottom-discharge batch can. These cans hang from a short section of tramrail attached to the framework of a skip hoist, running on inclined rails, leading to the main tramrail system at a higher level. Here, the can is moved off to storage lines serving the smelters. Batches for 24 hr. smelting can easily be made up and mixed during the day shift.

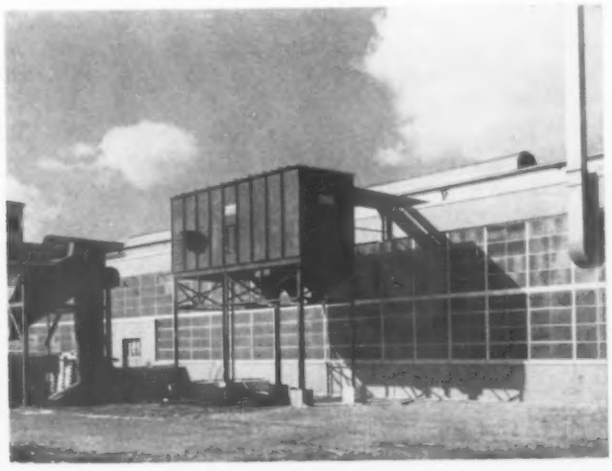
Quality Controlled

In a plant of this size, two reverberatory smelters for finish enamels are used, with 7' x 9' pots, 3,000 lbs. capacity. Charging of batches is through the smelter top, using nickel-chrome alloy steel funnels. After smelting, by pyrometrically controlled gas or oil firing, the batch is discharged into stainless-steel, perforated inner tanks, with trunnions on each end for power-lifting. The outer tank, a little larger, receives a steady in-pouring of enough cold water to fracture the molten enamel into frit particles. After completion of discharge, the metal tank contents is conveyed for discharge into a hopper feeding a long, porcelain-lined, cylindrical dryer. Dried frit is discharged from the other end of the dryer into containers for rail-transportation to frit bins.

Grip or slush enamels are made in about the same way in smaller smelters. They are milled wet, in a manner similar to sheet iron enamels. Dry process cast iron cover coats are milled dry, under close control, into powder form, with another passage over a magnetic separator and subsequent storage in tightly covered steel cans, porcelain-enameled inside and out. These are used for delivery to "powder monkeys" on a special, rubber-tired cart which side-dumps the can contents. The nearby enamel laboratory maintains a close control over all operations.

For inspection and packing, the cooled casting should be placed upside down on one end of a roller conveyor. The lower part of a crate or other packing is fitted over it, then after using a turn-over device, it is moved along the conveyor, right side up, for rigid inspection and completion of packing, then off to storage or shipping.

Dust collector is located outside the building—the proper place when space is available.



View of typical machine foundry floor, for production of cast iron bath tubs. Note overhead handling equipment.

By Grant S. Wilcox, Jr.

The Function of the Tool Engineer

In which a Master Mechanic Provides an Answer to the Perennial Question: What Is the Scope of the Tool Engineer's Duties?

The function of the Tool Engineer can be very simply defined: *to provide the machines and tools to produce the product engineer's design.* Paraphrasing the Confederate General Nathan Bedford Forrest, who is reputed to have said: "get there furstest with the mostest men," the Tool Engineer's job could be humorously described—make the mostest for the leastest. Actually, however, the duties of the Tool Engineer have a wider scope than either one of these definitions indicate. An enumeration of his responsibilities could run as follows:

The Tool Engineer's Job

(1) To devise the methods by which the product can be fabricated.

(2) To request and suggest changes in the engineering design to facilitate production, reduce cost and improve quality.

(3) To produce preliminary comparative estimates and final detailed estimates covering machinery, motors, fixtures, dies, tools, gages and time studies in order that your Cost Department and, finally, Management, may consider the feasibility of producing any particular part, or parts, as designed by the Product Engineers.

(4) To issue Authorization Requests (Requests for Appropriation), on the basis of accepted estimates, covering the purchase of machines and tools in his own plant and for tools which become company property at outside vendors of certain parts.

(5) To investigate and recommend for approval, or to reject and secure the re-adjustment of tooling expenditures and part price alterations, reported by supply vendors due to engineering changes.

(6) To select and rebuild machinery on hand and to recommend the purchase of new machinery.

(7) To write operation sheets and orders for the design, making, or alteration of the necessary tools.

(8) To guide and counsel the tool designer in producing designs coinciding with production plans.

(9) To accept or reject these designs, re-examine his original estimates and then release to the Purchasing Department or Tool Room for fabrication.

(10) To schedule and follow-up the deliveries of tool fabrication vendors so that production dates will be met.

(11) To provide the Plant Engineers with the necessary information so that they can furnish the facilities for housing and supplying the production lines with raw or semi-finished material, air, electricity, water, light, conveyors, and the many other services that are essential to make a manufacturing setup complete.

(12) To direct and instruct tool trouble men, production foremen and setup men, after the machinery and tools have been received, so as to assure top efficiency.

(13) To govern and control expenditures in order to prevent the over-run of Authorizations.

Qualifications of a Tool Engineer

From the foregoing, it can be seen that the Tool Engineer is a paragon of activity and his qualifications must necessarily be broad. Assuming a cooperative and balanced personality, he must also:

(1) Have a keen, logical mind.

(2) Be a first-class mechanic by nature—if not by training.

(3) Have a practical mechanical background.

(4) Operate under the philosophy that, "the difficult job can be done at once; the impossible takes just a little longer."

***Grant S. Wilcox, Jr.*, Ass't Master Mechanic, Plymouth Div'n, Chrysler Corp'n, was graduated from University of Michigan, in '32, with degree B.S. in Mechanical Engineering. A member of Detroit Chapter, A.S.T.E., and recently elected Director of the Society, he has served as Chapter Ch'man in addition to active committee work, both local and national. He is incumbent Ch'man, Sub-Committee, Nat'l Standards Com'tee. An enthusiastic flyer, he has written several articles on aviation that have been widely read.**

Processing and Estimating

As noted, the Tool Engineer's first step is to select the method by which he hopes to produce the Product Engineer's design. Several methods are usually open to him and, when this occurs, he must either be guided by past experience or produce what we term a comparative estimate showing the advantages or disadvantages of each method. One sequence of operations may call for a large expenditure on specialized machinery, but, in turn, will produce a lower direct labor cost. Conversely, another may involve a lesser expenditure, due to the use of standard equipment but, because of the greater number of operations involved, will produce a higher direct labor cost; while a third may strike an economic balance between the two extremes. Such a condition is brought about by technological progress in machines and tools with which every Tool Engineer must keep abreast. The decision as to the final method generally belongs to Management, inasmuch as they determine the long-term policies of a company and the manner in which any expenditure is to be amortized.

When Management has decided on one of these alternate methods, the Tool Engineer produces a detailed estimate covering all costs that he can foresee including not only machines, motors, fixtures, tools and gages, but also design, installation and setup. This estimate then becomes the basis by which he issues his Authorization Requests, as noted in Function No. 4.

In conjunction with this first step, and all through the process, the Tool Engineer has the opportunity to suggest changes in design or construction of the product in order to simplify production and thus reduce cost or improve quality. This is an extremely vital function and should be exercised regularly but with rare good judgment.

Vendor Control

As indicated in Function No. 5, the Tool Engineering Department should also watch and control tooling expenditures and part price changes by vendors to his plant. Engineering Changes after No. 1 production part are generally quite welcome to our suppliers, since it gives them an opportunity to readjust their prices and tooling costs to cover errors of judgment produced by competitive stress at the time the business was originally placed. The Tool Engineer who covers this phase of your activities must, therefore, in addition to his other qualifications, also be a first-class detective and an astute diplomat.

New Machines vs. Old

Function No. 6—"To select and rebuild machinery on hand and to recommend the purchase of new machinery" is self-explanatory and ties in very closely with Function No. 1. Obviously, it is mandatory to use machinery on hand whenever and wherever possible. On the other hand, used machines usually need rebuilding and must frequently be redesigned to perform an entirely new function. Work of this type is usually handled by the Machine Repair Department or by outside suppliers working under their direction.

Operation Sheets and Tool Records

Operation sheets should then be written and orders issued for the design, fabrication or alteration of all the necessary tools. Operation sheets not only describe the operation to be performed, but also enumerate in detail the machines and the quantity and classification of fixtures, dies, tools and gages. Fixtures can be listed on the operation sheets by a descriptive title and a number composed of a prefix, generally the number of part to be machined, followed by the letter "F" and an arbitrary number assigned to that particular item; for example, 956252-F-13. Dies (D), special tools (H and T) and gages (R and G) can be similarly described and numbered. The "H" classification, as the symbol would indicate, can cover tool holders and their accessories; while "T" tools are specially designed cutting implements. "Standard," or on the market tools, cover both "H" and "T" classifications, but are not designed by you and can be listed on the operation sheets by description only, followed by the notation "Std." "R," or receiving, gages are generally large and bulky and normally make several simultaneous checks; while "G" gages are usually small and portable and are confined to checking one or two dimensions.

Tool Design

The Tool Engineer's next function is to "guide and counsel the tool designer in producing designs commensurate with production plans." It is not meant by this that the Tool Engineer should interfere with the autonomy of the design department, which should be a separate entity reporting directly to the Master Mechanic, but the work of the two departments is so closely interwoven that one must supplement the other. As a matter of fact, it is general practice to promote the best Tool Designers to Tool Engineering.

Follow-through

As soon as designs are complete, the Tool Engineer should re-estimate the fabrication cost and release the design for placement by the Purchasing Department. "Follow-up" should then procure delivery promise dates and deliveries in order to meet the production schedule and handle the paper work incidental to this process. It should also be the duty of the Tool Engineer to furnish the Plant Engineer with complete information so that he can furnish all other facilities, over and above machines and tools, that are necessary to the functioning of the production lines as originally conceived by the Tool Engineer and approved by Management.

The last two Functions enumerated (No. 12 and No. 13) are the Tool Engineer's "piece de resistance," for after devising, designing and setting up the production lines, he *must* be able to make them work. If his preliminary work has been properly executed, this problem is moderated and merely consists of eliminating "bugs" and "bottle-necks." It is here that he should exercise the full breadth of his mechanical experience.

The governing of expenditures, in order not to overrun an authorization, is unusually difficult because the unforeseen frequently occurs. Here, experience should teach one to make appropriate allowances in original estimates.

Conclusion

To summarize, although the analogy is not perfect, a company engaged in manufacture might be compared to the human body wherein the Engineers and Management constitute the brain or motivating source; the Sales and Public Relations Department the eyes, the ears, speech and personality; the Accounting and Planning Departments the nerve system—flashing warning signs of inadequacies or excesses through the brain to all parts of the body; the Plant Engineers the framework and outer facilities; the Production Department the blood stream carrying life and nourishment to the entire body; and the Tool Division the heart and viscera providing the facilities that sustain life and compete with the market.

Future

Tool Engineering, in the writer's opinion, offers college men the most promising future among all the engineering professions. The trend of our economic thinking and planning during the past twenty-five years, places the man who can produce abundance at low cost at the helm of our growing economic order.

To substantiate this, without taking my word for it, you need only note that most of our large corporations are now headed by former mechanics and production men rather than by bankers or salesmen or lawyers as in the past. Why the college man has remained aloof from this field, I can only guess. The apprenticeship period is long and tough but his future is assured because a good production man cares not whether he is producing toy trains or locomotives, automobiles or munitions—all call for precisely the same skills, machines, tools and processes.

Since there is no limit to the human desire for ownership of manufactured goods, there is, consequently, a vast relatively unexplored field awaiting further development by the Tool Engineer.

New "Dry Cyaniding" Process

Perfection Tool & Metal Treating Company, 1740 West Hubbard St., Chicago 22, has developed a "dry cyaniding" process which is said to be an entirely new approach to the problem of putting a case on low carbon carburizing steel without embrittlement. In addition, distortion is said to be practically eliminated.

Case depths to .025", with unusually accurate control and with hardness in excess of 60 Rockwell C, are attainable. Also, a tougher core and generally more uniform results are claimed for the process, which is said to afford a safe answer where ordinary cyanide hardening is not good enough.

The company is prepared to demonstrate the superiority of the process and, for a limited time, will treat sample pieces gratis. Or, complete information will be furnished on request.

By Theodore Weber, Jr.

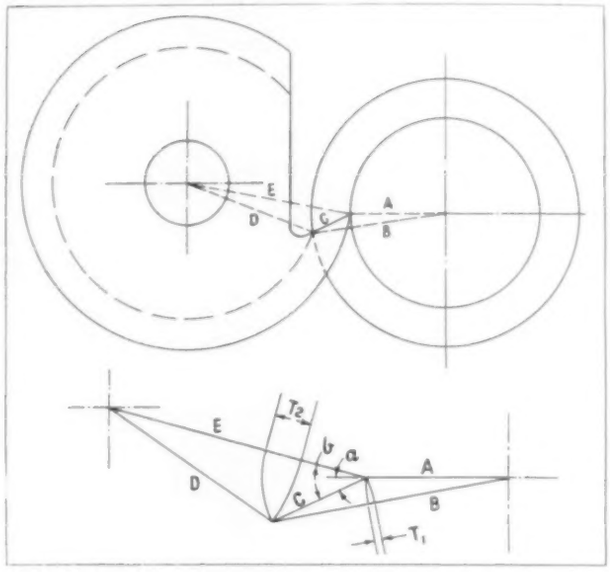
Formula for Circular Form Cutters

A Simple Approach to Calculation of Diameters of Circular Form Tools.

Calculating the diameters of circular form cutters, to correct for both top rake and offset, is ordinarily a time consuming operation involving the solution of two oblique triangles. Not only are the calculations quite involved, but the degree of accuracy required is such that the slide rule is out of the question, and the operator must resort to a calculating machine or six place logarithmic tables.

A brief investigation of the law of cosines, however, reveals that it can be factored to a form in which T_1 and T_2 can be calculated, which in turn can be added to the

Theodore Weber, Jr., **was born in Switzerland. Coming to the U. S. in 1920, he was subsequently graduated from Stevens Ins't of Technology with degree M.E. He has been process engineer with Alcoa, Eastern Aircraft Div'n of G.M.C., and Allen Eng'g Co., and is now Chief Design Eng'r with Palisade Eng'g Co., Ridgefield, N. J.**



REF. DIA. = A = .437
M = .00664
N = .1737
a = 10°

TOP RAKE	M	N
3°	.001370 A	.0722
5°	.003805 A	.0968
8°	.009730 A	.1403
10°	.015190 A	.1737
15°	.034060 A	.2722

2G

$M = (1 - \cos a)\,A$

$N = [1 - \cos (a + 9° 36')] \times 3.000$

TOOL NO. _____

	USE FOR RAKE OF 15° AND LESS											
Pc. Dia. B	.750											
A	− .437											
B − A	.313											
	1.000		1.000		1.000		1.000		1.000		1.000	
A/B	− .584											
1 − A/B	.416											
$T_1 = (1 - A/B)M$	.00276											
C = B − A + T	.31576											
*E + $T_2/2$ = F	3.000	→ 3.0102	3.000	→ 3.	3.000	→ 3.	3.000	→ 3.	3.000	→ 3.	3.000	→ 3.
F/C	9.50	9.54										
	− 1.000	− 1.000	− 1.000	− 1.00	− 1.000	− 1.000	− 1.000	− 1.000	− 1.000	− 1.000	− 1.000	− 1.000
F/C − 1	8.50	8.54										
$T_2 = \frac{N}{F/C - 1}$	.0204	.02035										
$T_2/2$	.0102											
E		+ 3.000		+ 3.000		+ 3.000		+ 3.000		+ 3.000		+ 3.000
E + T_2	3.02035											
− C	− .31576		−		−		−		−		−	
D	2.7046											

*ASSUME T_2 = 0 ON FIRST APPROXIMATION THEN E = F = 3.000

Work Sheet for Circular Form Tool Diameters on B&S 2G Screw Machine Using 3.000 Dia Tool Blank.

difference between the two known sides of each of the respective triangles to give the third.

The advantage of determining T_1 and T_2, instead of the actual sides of the triangles, lies in the fact that, over the practical range of top rake angles, these quantities are small compared to the sides of the triangles and can be computed on an ordinary slide rule with sufficient accuracy to protect the fourth decimal place in the dimension to which they are applied.

In the exact formulas for T_1 and T_2, it will be noted that the unknown is involved in the equation for finding the unknown. They can, however, be solved readily by the use of successive approximations. If the rake angle is 15° or less, the first approximation will give results for T_1 well within the accuracy of standard screw machines. The approximate form of the equation for T_1 may, therefore, be used directly. An equally satisfactory value for T_2 can be obtained from a second approximation—that is, using the approximate form to find T_2 and using this value in the exact form to get a new value for T_2.

$$B^2 = A^2 + C^2 + 2AC \cos a$$

$$(A + C)^2 - B^2 = 2AC\,(1 - \cos a)$$

$$T_1 = A + C - B = \frac{2AC\,(1 - \cos a)}{A + B + C} =$$

$$= \left(1 - \frac{A - T_1/2}{B + T_1/2}\right) A\,(1 - \cos a) \text{ Exact}$$

$$T_1 = \left(1 - \frac{A}{B}\right) A\,(1 - \cos a) \text{ Approx.}$$

$$D^2 = E^2 + C^2 - 2\,EC \cos b$$

$$D^2 - (E - C)^2 = 2\,EC\,(1 - \cos b)$$

$$T_2 = D - E + C = \frac{2EC\,(1 - \cos b)}{D + E - C} =$$

$$= \frac{E\,(1 - \cos b)}{\frac{E + T_2/2}{C} - 1} \text{ Exact.} \qquad T_2 = \frac{E\,(1 - \cos b)}{E/C - 1} \text{ Approx.}$$

Formula and example workout.

The error in any calculation can be found by noting the change in result upon carrying through an additional approximation. On a Brown & Sharpe No. 2G screw machine, using the maximum rake angle of 15°, the largest possible error in T_1 occurs when T_1 itself is largest, and that is when the piece diameter is 1" and the reference diameter is .500". The error in T_1, due to using the approximate equation, is then only .0001". T_1 itself is only .0086", which can be calculated on a slide rule to within .0001". On the same machine the largest possible error in T_2 occurs when T_2 itself is largest, and that is when the piece diameter is 1", and the reference diameter is zero. The error in T_2, after the second approximation, is then only .00015". T_2 itself is only .1318, which can be read to thousandths and estimated to tenths on the slide rule.

In the derivation A, B, D, and E are radii. The formulas are, however, equally valid when they are considered as diameters. A, the reference diameter, is the piece diameter at which the tool cuts on the horizontal center line of the piece. It is ordinarily the smallest diameter to be cut by the form tool.

Added Notes on Calculation of Pin Measurement

Editor, The Tool Engineer:

I studied Mr. Wright's article, "Calculations of Pin Measurement for Right and Oblique Cones," with considerable interest. It is a typical example of applied mathematics to tool design. The following variations are derived from a purely trigonometrical approach, and is submitted for comparison.

The value for X is .001" larger than Mr. Wright's answer (which was erroneously printed .2990" but is intended to be .289"). I do not know whether his or mine is the more accurate answer, but both are probably well within practical limits.

Adolph B. Harvest, Toronto.

From diagram given: d, r, < a and < b; to find X.

$X = h - i - r$ (1)

$h = d/\tan a + \tan b$ (2)

$L\,C = a + b/2 - b$

$i = r \operatorname{cosec}. a + b/2 - \cos C$ (3)

Substituting (2) and (3) in (1)

$X = d/\tan a + \tan b - r \operatorname{cosec}. a + b/2 - \cos C - r.$

Using same given values as in Mr. Wright's worked example:

$d = .475"$, $r = .21875$ < $a = 1°\ 46'$ and < $b = 2°\ 25'$.

Calculate X.

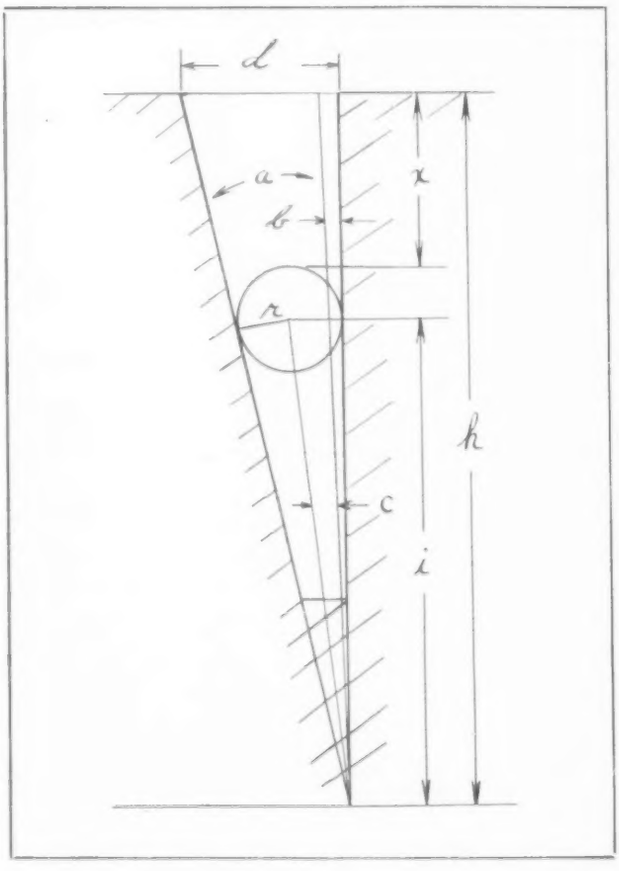
$X = .475/\tan 1°\ 46' \tan 2°\ 25' - .28175 \operatorname{cosec} 2°\ 5\frac{1}{2}'.$

Cos $0°\ 19\frac{1}{2}' - .21875 =$

$= .475/.07304 - (.21875 \times 27.404 \times 0.99999) - .21875 =$

$= 6.5033 - 5.9945 - .21875 =$

$= .290"$ answer.

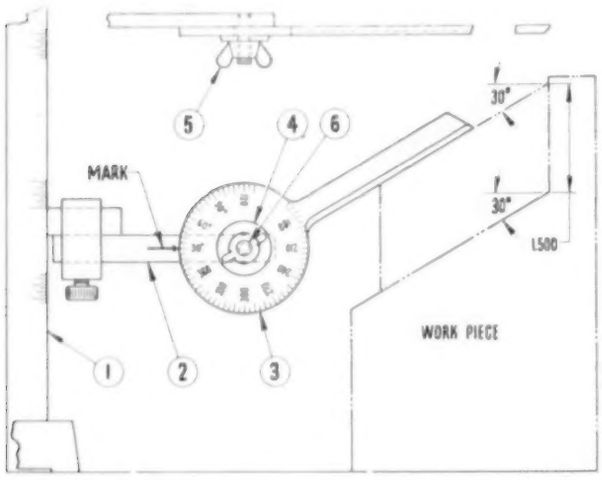


GADGETS

Ingenious Devices and Ideas to Help the Tool Engineer in His Daily Work

Angle Gage Attachment

This device is to be used with a standard height gage, and aids in checking angles and related dimensions in one set-up. It is very useful in tool rooms, inspection departments and machine shops. The tool doesn't require use of sine bars or special set-ups of angle plates, with incidental clamping.



The attachment can be made of C.R.S. throughout. Det. 1 is the height gage; 2 is the holding arm, made of bar stock machined to suit the height gage. Det. 3 is machined from flat sheet stock. The circular disk can be engraved or etched and the graduations can be spaced to 360° divided to suit your needs.

Det. 4 is a standard S.A.E. washer; 5 a standard wing nut, to fit the stud, Det. 6. The latter has a shoulder, the O.D. of which is slip fit to Det. 3. If desired, a spring washer can be interposed between 3 and 4; this tends to "brake" the protractor when marking adjustments.

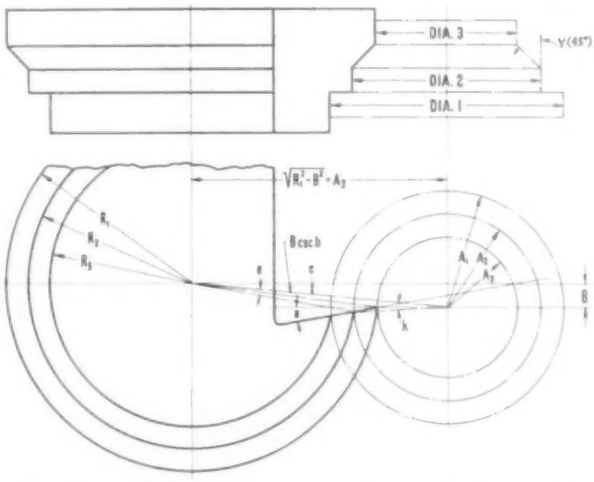
Frank J. Peragine
Greater New York Chapter, A.S.T.E.

Formula for Compound Tools

Several inquiries have come to hand for information relative to a formula for calculating the diameters of the various steps of circular and flat form tools with positive (hook) or negative rakes. An article on calculations for form cutters, by Theodore Weber, Jr., appears on page 40, this issue, The Tool Engineer; however, this deals primarily with simple form cutters.

No one formula could be practically applied to compound cutters with rake, for the reason that the diameters would change with the degree of rake. Hence, each step would have to be separately calculated. A formula, with illustration, contributed by Leonard Johnson of American Consolidated Engineers, Detroit, deals with compound form tools.

—*Ed.*



When large diameter of cutter is given and angle of rake is a . . .

(1) $\tan c = B/\sqrt{R_1^2 - B^2} + A_3$

(2) $\sin b = A_3 \sin a/A_2 < a + < c - < b = < k$

(3) $\cot e = B \csc c \csc k/A_2 - \cot k$

(4) $R_2 = A_2 \sin k \csc e$

Corrections and Announcement

In the Directory of Exhibitors, for the recent A.S.T.E. New Era Exposition, the listing opposite Fonda Gage Co., Stamford, Conn. (Space 405) was in error. The listing should have read:

Fonda Lifetime-Carbide and Steel gage blocks, with Fonda Ultra Finish, in complete sets and individual sizes. Manufactured in grades "AA" (± .000002"), "A" (± .000004"), "B" (± .000008") guaranteed tolerances. Not only meet all rigid National Bureau of Standards requirements, but surpass most of those demands. One Lifetime-Carbide gage block will outlast more than 100 steel blocks. Also special Gages, Dies, jigs and fixtures.

~ ~ ~

In the biographical sketch of Paul H. Winter (Elements of Electric Circuits, April The Tool Engineer) it was implied that he had been connected with Sperry Gyroscope Co. as Chief Methods Engineer. His position with Sperry was that of Senior Methods Engineer.

In "Shaving Facilitates Camshaft Production," Page 35, April The Tool Engineer, the photograph of the shaving operation, lower right, is shown inverted. The cutter should be at the top, the work below.

~ ~ ~

Due to extra coverage incidental to the late A.S.T.E. Exposition, we have found it necessary, this issue, to omit the following Departments: Good Reading, Bulletins and Trade Literature, and the Fundamentals of Tool Engineering. However, these departments will be resumed in the June issue, The Tool Engineer.

With regard to the Fundamentals of Tool Engineering, a new series, now in preparation, will start in the August issue. For June and July, we will run two mechanical articles—Electrical Units and the Relation to Measurement —by Dr. John J. Caton.

Ed.

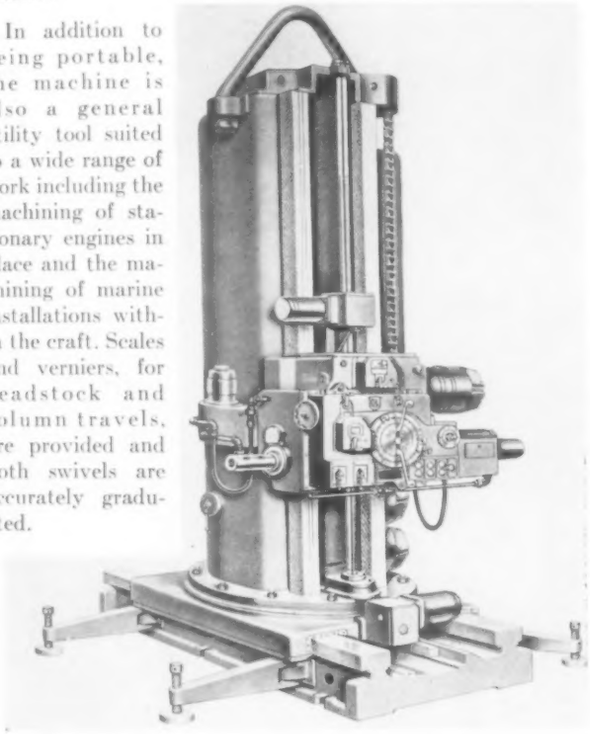
TOOLS OF TODAY

G & L Multi-Purpose Portable

Giddings & Lewis Machine Tool Company, Fond du Lac, Wis., announces a new portable **MULTIPLE PURPOSE MACHINE TOOL** designed to perform unusual drilling, tapping, boring, milling and facing operations. In addition to being portable, the machine features a swivel head and swivel column that permits unusual latitude in the alignment of the spindle for correct position when machining work. The column swivels 360° and the headstock 45° up or down from horizontal.

Since the machine is taken to the work, instead of the work to the machine, the size of the work has little if any influence on what can be machined provided that the G & L machine can be placed in the desired position. The unit is provided with a lifting bale and may be lowered through an opening as small as 100 inches in diameter. Once placed, practically any surface may be reached in the interior.

In addition to being portable, the machine is also a general utility tool suited to a wide range of work including the machining of stationary engines in place and the machining of marine installations within the craft. Scales and verniers, for headstock and column travels, are provided and both swivels are accurately graduated.



Non-Corrosive Rust Remover

A NEW **RUST REMOVER** has been perfected and a plant set up for its manufacture by the *Nox-Rust Chemical Corporation*, Chicago 8, Illinois. This new product wets metal thoroughly; dissolves rust scale rapidly, removes it completely and is relatively non-corrosive to steel even under conditions of long exposure. Ordinary rust removal takes only a matter of seconds, however, leaving no perceptible etching or discoloration of surfaces.

This rust remover can be applied by brush, spray and dip, and is available in pint to tank car quantities. Further information and technical data may be had from the manufacturer.

New Cinci-Bickford Drills

THE *Cincinnati Bickford Tool Company*, 3235 Forrer St., Cincinnati, announces a new line of Super Service Direct Drive **UPRIGHT DRILLS** especially designed for high production industries. These machines are said to have the flexibility of a general purpose machine with the simplicity of mass production tools.

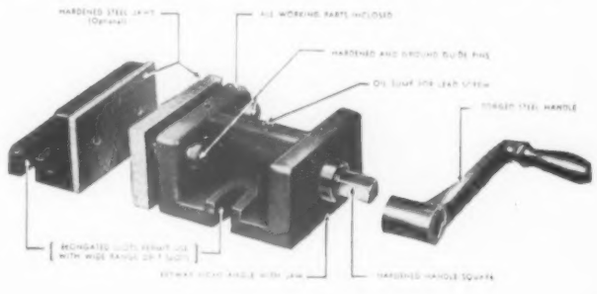
Built in 21", 24" and 28" sizes, the machines are equipped with driving motors 3 to 10 hp. Motor speed is 1200; however, 900 or 1800 rpm motors can be supplied if lower or higher spindle speeds are required. Where the machines are to be used for tapping, or for other operations requiring spindle reverse, the motors will have Magnetic Reversing Starters. Sixteen spindle speeds, and 8 feeds, are obtainable through numbered pick-off gears which may be rearranged as required.

Adjustable automatic Tapping Reverse, with Tap Leads, are available for production tapping. Tap leads will be of gear drive type, for perfect lead. Scale reading provides for drilling plus or minus .005"; however, a special "dwell" can be provided for facing within .001". Spindle and sleeve are carefully counterbalanced by one-piece counterweights inside the column. Removable section weights can be furnished if machine is to be used with multi-drill heads. The Cincinnati Bickford Tool Co. Booklet U-27 gives complete specifications.

Milpal Vise Has Wide Range

A NEW TYPE of machine vise—**MILPAL**—by the *Porterfield Mfg. Co.*, 749 E. 15th St., Los Angeles 21, has infinite range of jaw opening from zero to 90 per cent of the length of a T-slotted machine table.

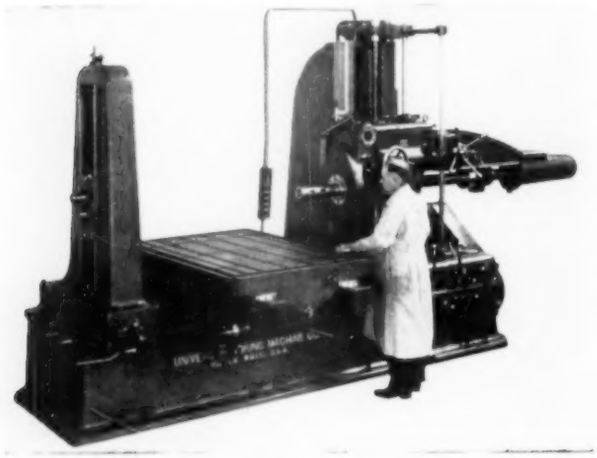
The fixed and movable jaws are separate units, with the table taking the place of the conventional vise base. Construction is heavy. The clamping screw is 1"-6, engaging in a bronze nut, and alignment is assured by conventional keys. The vises are available in jaw widths 5", 7" and 9".



New Universal Borer

A 4″ spindle machine with a speed range of 8 to 1000 r.p.m., and a 5″ spindle machine, 7 to 850 r.p.m., are manufactured by *The Universal Boring Machine Co.*, Hudson, Mass. These machines are offered with a selection of ranges as follows: 36″, 48″, or 60″ vertical range; 72″, 96″ or 120″ from face plate to outer support, and with 40″ x 60″, 42″ x 72″ or 48″ x 84″, tables.

Electrical equipment comprises a 20 h.p. motor which is controlled through a swinging type pendant push button, giving forward, forward jog, reverse, reverse jog and stop.



Tracing Reproduction Machine

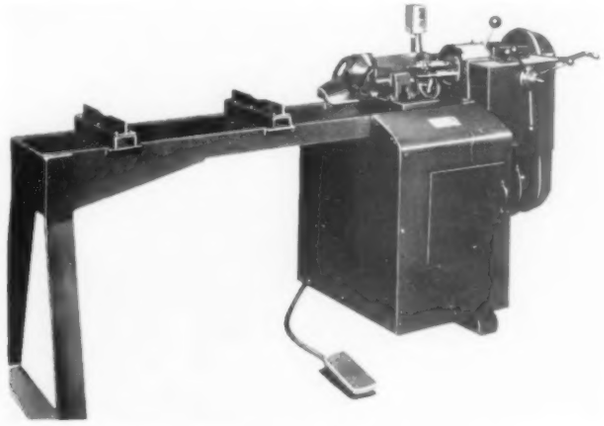
C. F. Pease Co., Chicago, has produced a new dry circuit process **PRINTING AND DEVELOPING MACHINE**—Model 88-R—for economically producing high quality Whiteprints. A 75-watt per inch high pressure mercury tube placed within the contact cylinder emits an even and correct amount of light over the full width of the tube. With this cylinder printer it is easy to convert from revolving to sliding contact by using a simple clutch lever. The contact cylinder is cooled by the same blower which forms the vacuum to convey exposed prints to the ammonia fume developer.

Safety features include confined control of ammonia fumes and complete enclosure of all dangerous moving parts. Electrical circuits are behind locked doors which automatically break the high voltage when opened.

Sturdily built, all parts exposed to ammonia fumes are of stainless steel or aluminum. Feeding is manual but virtually everything else is automatic and the operation is continuous at speeds up to 30 f.p.m.

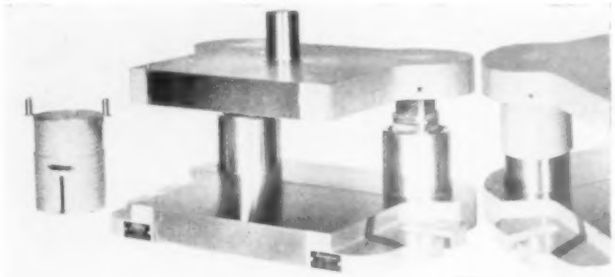
Special Drilling and Tapping Machine

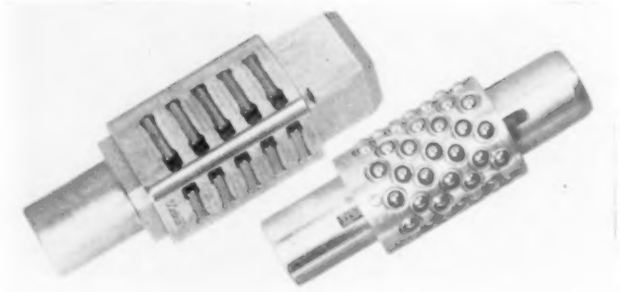
A HORIZONTAL **DRILLING AND TAPPING MACHINE** for extra long pieces, up to 96″ in length with only one handling, is a product of *The Cleveland Tapping Machine Co.*, 3610 Superior Ave., Cleveland. A workpiece is drilled, then indexed to tapping position and tapped to proper depth. Each spindle is independently adjusted for depth of travel to within .010 inch. The machine can drill and tap from ⅛″ to ½″ N.C. in steel.



Anti-Friction Die Sets

ORIGINALLY DESIGNED for use with the Lempco Punch Presses but applicable to any punch press operating at high speed, new, precision, **ANTI-FRICTION DIE SETS**, by *Industrial Div'n, Lempco Products, Inc.*, Dunham Rd., Bedford, Ohio, employ ball or roller bearings to prevent "freeze" of guide pins.

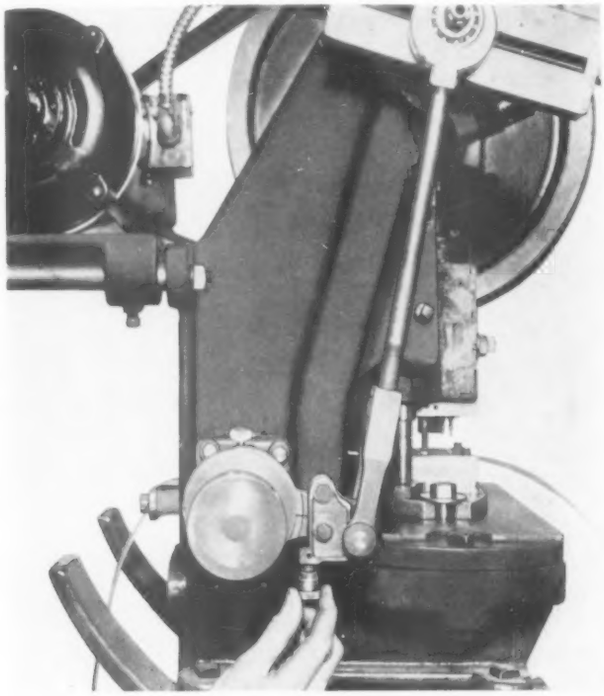




Round pin sets employ ball bearings, and the square pin type roller bearings. Bearings are pre-loaded, and it is claimed that, after test runs of 18 million strokes, the preload remains but slightly reduced. Because of this, play is reduced to a minimum; besides, the sets open or close freely by hand. Descriptive literature, now being prepared, will be sent on request.

New Friction Feed Unit

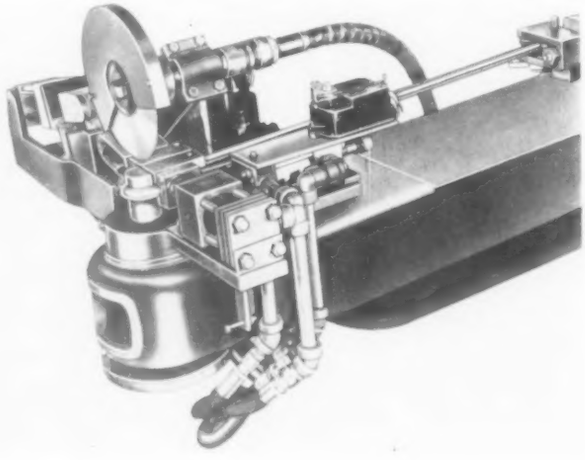
A NEW TYPE **FRICTION FEED UNIT**, for power presses, announced by the *Carl G. Peterson Co.*, 9 Warren Ave., East Providence, R. I., is featured by a patented micrometer adjustment for close tolerance work. Grip is controlled by an adjustable, self aligning, metallic brake, thus insuring the positive brake action which is highly important in a friction feed unit. Application is simple, and the unit, which may be adjusted to feed in reverse, is readily secured to feed rolls.



Automatic Cut-Off for Benders

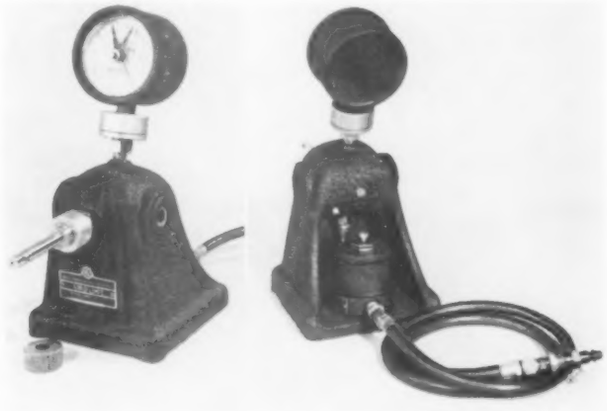
Pines Engineering Co., Aurora, Ill., recently announced an **AUTOMATIC CUT-OFF** for all sizes of Pines Tube & Pipe Benders.

The No. $^3/_4$ Pines Hydraulic Bender is equipped for full automatic manufacture of return bends or elbows. In operating the bender, a long piece of tubing is placed over the mandrel and the "start" button pressed. After the machine finishes the bend, the mandrel is extracted and, before the clamps are opened, the saw is passed through the tube by means of hydraulic power. Typical production is 650 pieces bent and cut per hour from $^3/_4$" copper tubing.



P&W Adjustable Compensator

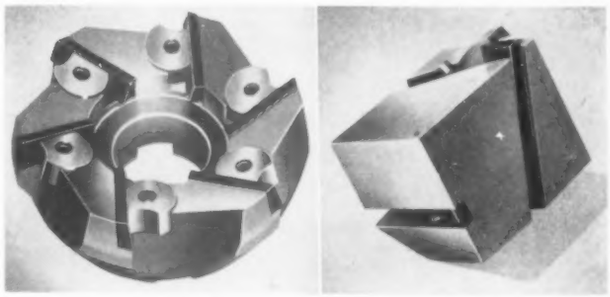
AN ADJUSTABLE **COMPENSATOR**, providing higher magnification for the P & W Model B2 Air-O-Limit Comparator, is announced by *Pratt & Whitney*, div'n Niles-Bement-Pond Co., W. Hartford, Ct. Readily attached to the Comparator, the Compensator allows full scale graduations of .0004", .0006", .0008" and .001" to replace the full scales of .002", .003" and .004" commonly used. The photo shows front and rear views of the Comparator-Compensator combination.



Solid Blade Face Mill

SAID TO OFFER many advantages over both brazed tip and conventional inserted blade cutters, a new **FACE MILL**, by *Beaver Tool & Eng'g Corp'n*, 2850 Rochester Rd., Royal Oak, Mich., features solid carbide blades. The blades are quickly released and exchanged by releasing the locking wedges.

When provided into a fixed position radial rake of 15°, the blades may be sharpened to any effective rake angle, positive or negative. A grinding block, provided for sharpening the blades individually, insures uniformity of rake and height. The tools are fully described in a bulletin, available on request.



"Tool Flex" Tool Holder

MODEL B "Tool Flex" **TOOL HOLDER**, by *Burg Tool Mfg. Co.*, 6709A San Pedro St., Los Angeles 3, floats in oil resistant Neoprene. The holder is self aligning, providing accurate centering of tools when tapping, reaming, boring and counter-boring.

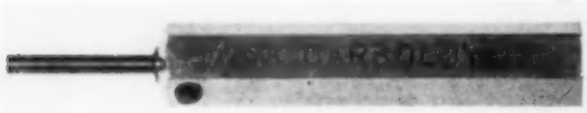
It is especially suited for follow-up work on larger multiple spindle or hand screw machines.

New Yankee Surface Gage

A VISUAL, AUTOMATIC, electric surface gage, by *The Yankee Precision Products Co.*, Hartford, Conn., quickly and accurately measures the flatness of machined surfaces. Test recordings on typical pieces have indicated that variations of as little as .000005" may be measured. In operation, the workpiece is laid upon the surface of the gage and, in the case of perfect overall accuracy, all of the electric bulbs will be illuminated. Where high or low spots appear, the bulbs in the equivalent positions on the duplicate work pattern will not light, and the percentage of inaccuracy will be indicated by an electric meter.

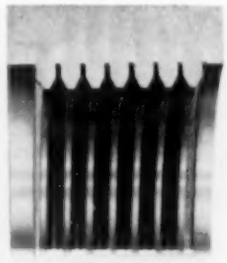
New Van Keuren Gages

CARBOLOY WIRE TYPE **PLUG GAGES** and **THREAD MEASURING WIRES** have been added to their line of precision gages by the *Van Keuren Co.*, 176 Waltham St., Watertown, Boston. These gages are made in sizes from .020" to .250". Lengths of the units are 1⅞ up to .100", and 2" in the larger diameters. They are made to Class B tolerances of plus or minus .000025"—or coarser or finer as specified. Wires for checking national 60° threads, 6 to 20 pitch, are immediately available.



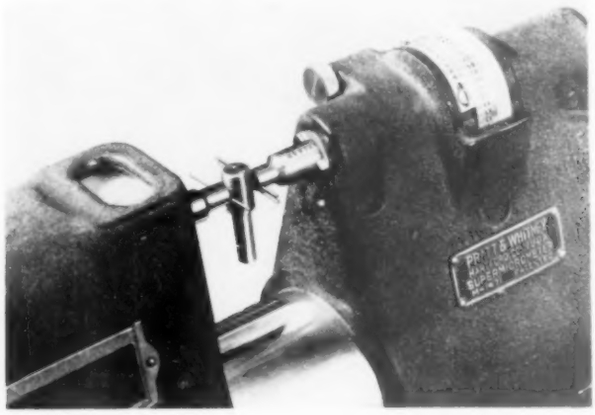
Thread Gages With Clearance

A NEW **THREAD RING GAGE** with clearance below the roots of the threads, makes it possible to "set down" or adjust the gages to take the advantage of the adjustment provided in ring gages, is manufactured by the *Locke Gage Co.*, 10232 Woodward Ave., Detroit 2. This clearance permits lapping of the entire side of each thread and reconditioning of worn-out gages.



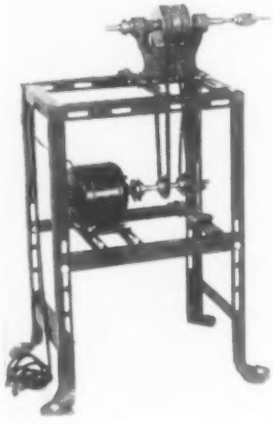
Precision Measuring Wires

A COMPLETE LINE OF **THREAD AND GEAR MEASURING WIRES** made of Carboloy cemented-carbide by *Lincoln Park Industries*, 1719 Ferris Ave., Lincoln Park 25, Mich., are ground and lapped to standard tolerances closer than N.B. of Stds. specifications. Accuracy is claimed to be retained at least fifty times over that expected of steel wires, and possibility of "flats," with resultant inaccurate readings, is practically eliminated. These wires are supplied in sets of three, contained in glass bottles labelled to show the size and the wire-constant corresponding to the number of threads per inch. Wires for N. S. 4 to 36 pitch are available from stock.



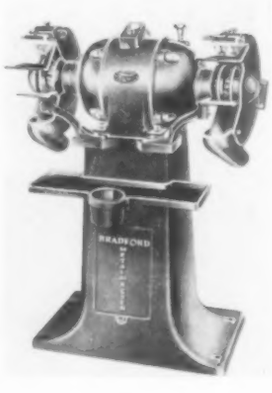
Star Tapping Machine

THE **STAR FRICTION DRIVE TAPPING MACHINE,** built by *Samuel S. Gelber*, 32 S. Jefferson St., Chicago 6, is simple to operate. The machine has the following features: A fractional horsepower motor can be used; the stand is adjustable to keep belts tight; the spindle runs in bronze bearings. A ⅜" three-jaw keyless chuck is furnished with other accessories. It suffices to press lightly on the work and the back friction driving surface starts the tap into work. A slight pull on the work reverses the tap.



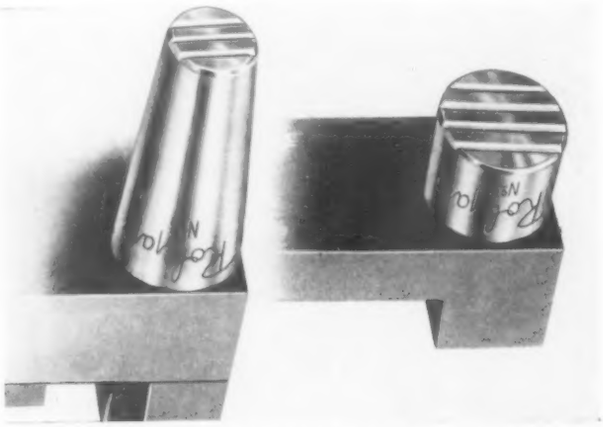
New Electrical Tools

The Bradford Machine Tool Co., Evans St., Cincinnati 4, Ohio, has greatly expanded facilities to include manufacture of a complete line of Metal Master electrical tools along with production of Bradford Metal Master Lathes. Included is the **METAL MASTER GRINDER,** which is supplied with extra-heavy duty motor, oversize ball bearings and overload protection as well as under-voltage release and spark breakers. Descriptive literature is available on request.



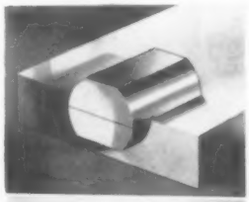
Legs and Buttons for Jigs

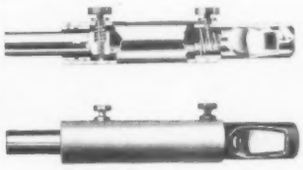
STANDARDIZED **LEGS AND BUTTONS** for jigs and fixtures are offered by the *Rolyan Metal Products*, 2330 W. 58th St., Chicago 36. Entirely interchangeable, they are made up in a large range of sizes. A full-scale dimensional print is available and will be mailed on request.



Opti-Locator and Datum Block

A NEW SIMPLIFIED optical device—**OPTI-LOCATOR**—for use in centering and measuring problems on all types of machine tools is manufactured by the *Benton Company*, 351 La Brae Ave., Los Angeles 36, Calif. Primary uses of the Opti-Locator are: locating layouts, work edges, lines or punch marks to any revolving spindle axis; accurately aligning a rotary table axis to a machine tool spindle; centering a spindle axis equi-distantly between opposing faces of a V-block for machining circular stock; and locating centers of holes from which measurements are to be taken. The Datum Block is an accessory which increases utility of the Opti-Locator.

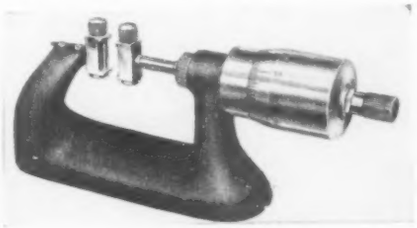




Swiss Screw Thread Micrometer

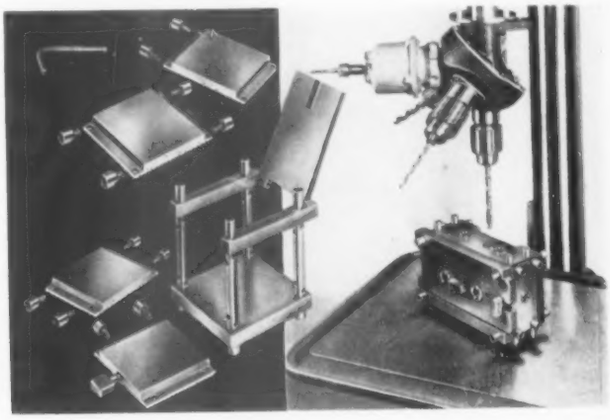
DISTRIBUTED in this country by *Park Sales Co., Ltd.*, 3 Park Place, New York, a **SWISS MICROMETER** has a non-revolving spindle and special attachments. To each of the anvils of the micrometer is attached a wire holder, one of which contains one wire and the other two wires, set in holders in a position which corresponds approximately to the inclination of the screw thread to be measured.

A folder containing important tables giving standard screw measurements, and a formula for obtaining the measurement from the "mike" reading, will be mailed on request.



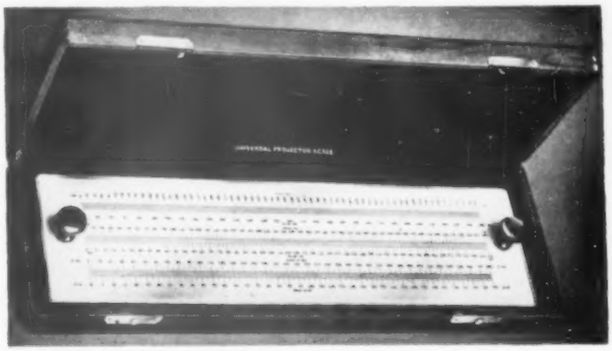
New Type Box Jigs

NEW BOX TYPE DRILL JIGS—named ***DRILLET***, is announced by *Chicago Drillet Corp'n*, 928 So. Michigan Ave., Chicago 5. These jigs are of the "assembled" leaf type and are available in 150 different sizes in square and rectangular shapes to accommodate a wide variety of work up to 6 inches. Of special advantage, the jigs can be used on all of its six sides. Because of standardization, savings up to 75 per cent, in design and construction, are demanded for these tools. Literature available.



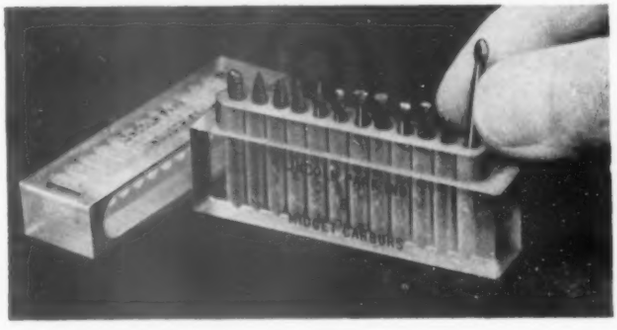
Projector Scale

A UNIVERSAL **ALL MAGNIFICATION PROJECTOR SCALE** is offered by the *Universal Engraving and Color Plate Co., Inc.*, 980 Ellicott St., Buffalo 8, N. Y. It is employed in the lens system of optical comparators in tool rooms and gage laboratories. Overall size, 4" x 14¼"; size of scales, approximately 12 inches.



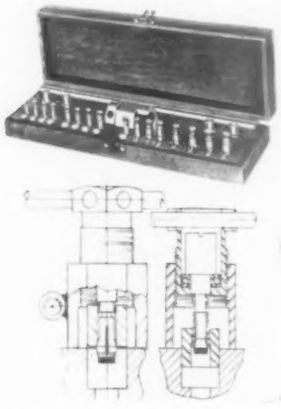
Midget Carburs

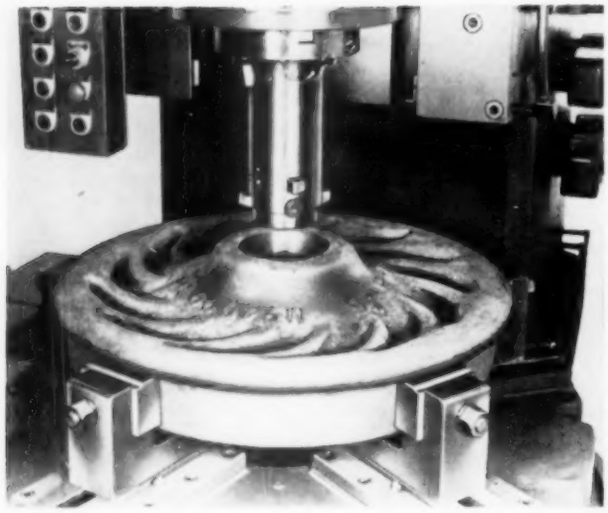
ROTARY FILES of solid tungsten carbide, 1⅛" overall with ⅛" dia. shanks are manufactured by *Lincoln Park Industries*, Lincoln Park 25, Mich. They replace hand files and mounted grinding wheels and are used on practically any materials, including hardened steel up to 65 Rockwell C.

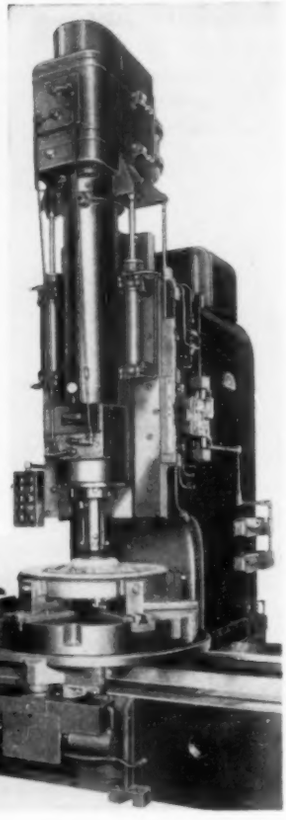


Die Extractor

DESIGNED to facilitate the removal of inserts, a pierce die insert **EXTRACTOR** is announced by *Buldoc Specialties Co.*, 10074 Beechdale, Detroit 4. Model B32 (shown) consists of 16 extractors which will remove any insert from .258" to .520", and can be used with the die in the press. The Extractor also removes slip fit inserts held with set screws or patent locks, although a hand knob or jack may be used, depending on fit.





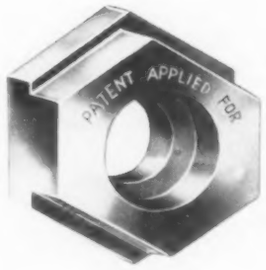


Car Wheel Boring

THIS special-purpose, **AUTOMATIC-CYCLE MACHINE**, for rough and finish boring wheels for railroad cars, is built by *Snyder Tool & Engineering Co.*, 3400 E. Lafayette, Detroit 7, Michigan. It combines accuracy with increased production rate and is engineered to maintain its efficiency over an estimated lifetime of 20 years. Chamfering and facing a 1½" flange may be performed simultaneously with the boring operation. Work is held by two 5-jawed chucks of 42" capacity, operated by individual hydraulic cylinders. Work cycle is automatic.

Universal Fixture Key

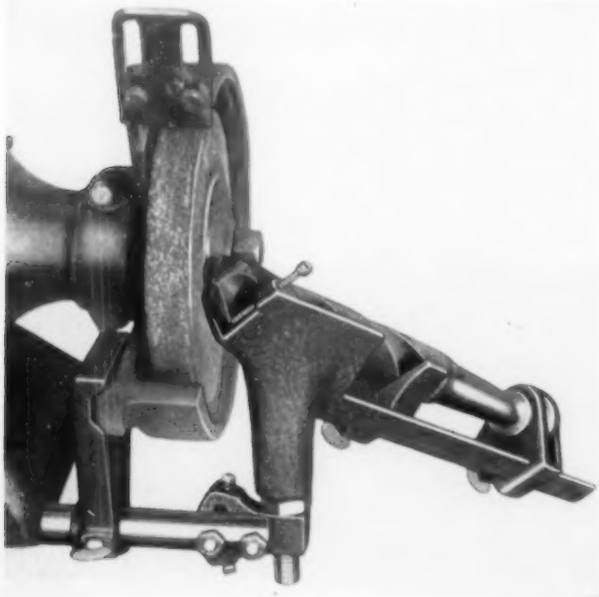
A UNIVERSAL **MILLING FIXTURE KEY**, by *Vlier Mfg. Co.*, 4552 Beverly Blvd., Los Angeles 4, enables fixtures to be used on any milling machine or T-slotted table regardless of width of slots. Sizes available are $^{13}/_{16}$-$1^{1}/_{16}$ x $^{5}/_{8}$"; $^{3}/_{4}$-$1^{1}/_{16}$ x $^{5}/_{8}$"; $1^{1}/_{16}$-$^{9}/_{16}$ x $^{1}/_{2}$" and $^{9}/_{16}$-$^{1}/_{2}$ x $^{3}/_{8}$". Tolerances are closely held plus or minus .0005".



Improved Grinding Fixtures

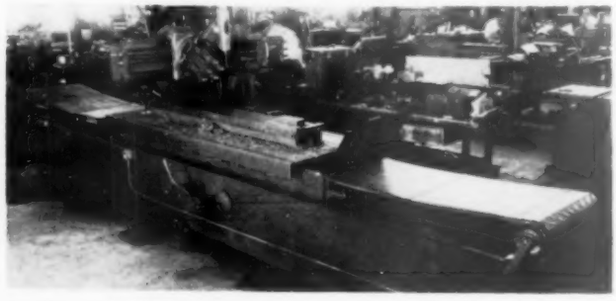
THE *Industrial Manufacturing Co.*, 1900 Euclid Ave., Cleveland, Ohio, offer improved **IND-L-WAY DRILL GRINDING FIXTURES**. The two available models handle all sizes of drills from ¼" to $2^{7}/_{8}$" in dia. and up to 26" long.

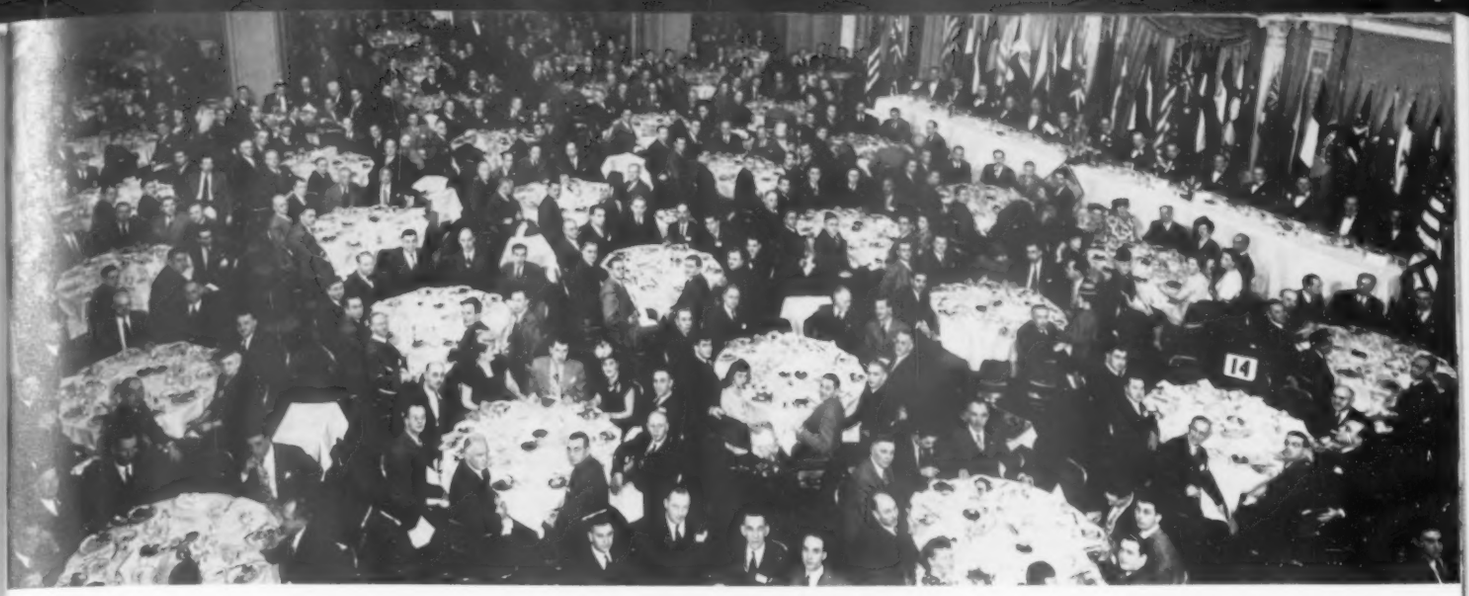
Ind-L-Way Fixtures are made for use with Black & Decker and Van Dorn bench and pedestal grinders, or other makes of grinders having the same dimensions, and provides all the advantages—speed, precision and economy—of machine drill grinding. Literature available.



Tosco Way Curtains

A "NEW" of particular interest to machine tool users is the Tosco **WAY CURTAIN**, designed to protect the ways of machines from chips and abrasive dust. A product of *Tool Supply Company*, 40 Custer, Detroit 2, these curtains are currently available in roll diameters 1", 3", 4" and 6", and in lengths (way width) 6" to 60". A descriptive bulletin gives full information.





53,250 Attend A.S.T.E.'s Greatest Exposition in Cleveland

By Doris B. Pratt

SURPASSING ALL EXPECTATIONS of exhibitors, visitors and the Society itself, the ASTE New Era Exposition at Cleveland Public Auditorium, April 8-12, was rated best industrial show of its kind ever staged. Tool Engineers and industrial technicians alike marvelled at the ingenuity shown in devising automatic multiple-operation machines for mass precision production. Economical machining operations with the thousands of new tools displayed provide another weapon for combating inflationary tendencies in soaring wages and material costs.

Top: ASTE Annual Dinner taxes capacity of Grand Ballroom in Cleveland's Hotel Statler. Above: "Take over, young fellow," says C. V. Briner in relinquishing Society Presidency to his successor, A. M. Sargent. Left: Arriving at 7:00 A.M., Eric A. Boener (right) of Pittsburgh wins bet with his Chapter to be first man to enter Show. A few moments later he was joined by Gustave C. Lesche of Schenectady Chapter. Below: This crowd of early registrants made it necessary to advance Exposition opening hour first day of show.

At Bureau of Ships booth Com. A. M. Johnson of the Executive Office, Secretary of Navy, and a member of Rockford Chapter, ASTE, explains construction of the 20-foot MK-14 submarine torpedo. Behind him group sees demonstration of torpedo firing mechanism which Potomac Chapter members helped develop. Chief Cochrane's tribute to the Tool Engineer is theme for exhibits of scale model AOG Ship machine shop, submarine reduction gear, and first axial-flow, turbo-jet engine built in this country. Right: Eager crowd surrounds registration desk before Monday morning show opening. Staff from National Headquarters handled registration and information service.

Various attractions command attention at a busy corner in the main Exhibit Hall. Right: Sunday evening preview by Society officers begins at ASTE booth: L. to r.: A. M. Schmit, H. E. Conrad, V. H. Ericson, W. B. Peirce, R. H. Morris, A. M. Sargent, C. V. Briner, R. B. Douglas, W. J. Frederick, T. P. Orchard and W. A. Dawson assemble for advance inspection tour of Exposition.

These ASTE'ers sacrificed two nights' sleep to see Exposition. Photo shows their midnight departure by chartered bus from Hamilton, Ont. Return trip was made the following night. Right: Serious concentration on displays and demonstrations was apparent throughout Exposition.

Cruising at 190 miles per hour in a chartered, twin-engined Beechcraft Executive Airliner, these Indianapolis members reached the Cleveland Exposition in an hour and a half. They are (l. to r.) John Horton, Paul Durant, Joseph Enright, Ernest Taylor, Howard Meyer, Robert Mattson and Clarence Wetzel. In plane's doorway is their pilot, Col. Roscoe Turner. Right: Director L. J. Radermacher and guest, arriving from Milwaukee in the former's new 600 hp P. W.-engined Noorduyn Norseman, are greeted by Cleveland friends. Extreme left and right: John and George Miller of Cleveland. Center: L. T. Wright and Mr. Radermacher (right), both of Milwaukee Chapter.

Technical Advances Displayed, Described

FROM EVERY SECTION of the United States, from "south of the border," Canada, England, Sweden, Switzerland, Africa, the Orient and other parts of the world, production executives arrived at the Exposition by land, sea and air.

Private and chartered planes filled airport hangars, typifying the modern spirit of the big show.

Registrants were impressed with the caliber of companies participating, while exhibitors were equally pleased with the high technical intelligence of the strictly invitational attendance.

Discussions of timely engineering problems, by prominent authorities, drew audiences of several hundred twice a day. Programs sponsored by the National Education Committee featured speakers from engineering colleges and an officer of a highly-developed production engineering society in England.

Educators, who with their accompanying engineering students accounted for some 3000 of the more than 53,000 visitors clocked into the Auditorium, enthused in their praise of the 350-booth Exposition.

Cost-cutting factors emphasized in exhibits and technical talks were: faster metal cutting, longer tool life, improved tool design, better materials handling, and multiple-operation machinery.

Greater use of carbide cutting tools and wider applications of pneumatic, hydraulic and electronic controls were also stressed to speed up the current program of retooling to produce new merchandise.

Success of the Exposition was apparent in the frequency with which departing visitors asked: "When will ASTE hold its next show?"

In a jovial mood for their "Tool Engineering and Profits" session are (l. to r.) Chm. H. E. Linsley, speakers A. G. Bryan, Ralph E. Flanders and C. E. Ives, and Nat'l Program Chm. H. D. Hall. Right: Chm. E. W. Baumgardner greets his speakers on "Hydraulic Controls and Drives." L. to r.: B. P. Graves, L. A. Trofimov, Mr. Baumgardner, L. R. Twyman and G. A. Caldwell.

J. F. Allen (left) and A. H. d'Arcambal (right), speakers on "New Techniques in Cutting Tools," await technical questions which Chm. R. W. Ford is inviting from audience. Right: Nat'l Education Chm. O. W. Winter presents Prof. O. W. Boston left and O. B. Jones (right) who discussed "Tool Engineering Education and Professional Development."

Pleased with their Certificates of Appreciation are (l. to r.) P. V. Miller, A. L. Davis, E. S. Marks and J. G. Manuele. Stephen Urban (extreme right), Chm., "Economic Control of Quality" symposium, presented testimonials. Right: "Tool Engineering Advancement" on two continents was compared by C. E. MacQuigg (left) and E. W. Hancock (right). O. W. Winter chairmanned panel.

Participants in "Cutting Fluid" session included (l. to r.) F. W. Lucht, W. H. Oldacre, D. J. Wangelin, Chm. F. J. Schmitt and Joseph Geschelin. Right: Opening technical session is called to order by Chm. W. B. McClellan (right). Appearing on this program were (l. to r.) A. W. Kramer, Jr., Otto Ewert and H. B. Shaw.

Below: Specific phases of "Tooling for Permanent Molds" were treated by K. T. Kuck and H. O. Poock. The latter was assisted by four experts who answered questions from the floor. The group (l. to r.): Donald Fair, Ray Fogle, Mr. Kuck, James Hutchison, Mr. Poock, Guy Jones and Chm. Earl V. Johnson. Right: Typical of technical session audiences, throughout the convention, this alert, interested gathering fills Cleveland Auditorium Ballroom.

Retiring President C. V. Briner administers oath of office to incoming administration. L. to r.: W. A. Dawson, Asst. Sec'y-Treas.; V. H. Ericson, Treas.; R. B. Douglas, Sec'y; I. F. Holland, 3rd V.P.; T. P. Orchard, 2nd V.P.; W. B. Peirce, 1st V.P., and A. M. Sargent, Pres. Right: The new National executives hold their first business meeting. Exec. Sec'y H. E. Conrad is fourth from left.

The Education Committee's accelerated program is discussed at meeting called by Chm. Winter. L. to r.: A. M. Sargent, E. M. Bertschi, C. C. Gorham, Prof. Halsey Owen, Mr. Winter, E. W. Hancock, O. B. Jones, E. L. Addleton and C. A. Vogt. Mr. Hancock of the I.P.E. in England described educational methods used in his country. Right: Business scheduled for Board consideration is studied by the Resolutions Committee. L. to r.: H. R. Shearer, Chm. I. F. Holland, H. D. Jones, Exec. Sec'y. H. E. Conrad, W. J. Gamble and K. C. Jasper. R. B. Douglas is temporarily absent to attend simultaneous meeting of Handbook Committee.

Chapters throughout the United States and Canada sent representatives to the first House of Delegates to elect new Board of Directors. Delegates are (l. to r.), 1st Row: Chm., H. R. Wentzell, South Bend; Sigurd Lunde, Tri Cities; J. M. Speck, Cedar Rapids; C. D. Wright, Niagara District; E. W. Kay, Detroit; M. W. Seavey, San Diego; A. D. Lewis, Los Angeles; F. L. Delhagen, Nor. N. J.; J. H. Shafer, Williamsport; J. O. Knight, Peoria. 2nd Row: Gardner Young, Pittsburgh; L. J. Kaufman, Fond du Lac; R. E. Crawford, Toronto; J. E. Ball, Hamilton; Scobey Rogers, Jr., Nashville; G. A. Goodwin, Dayton; F. C. Koehn, Milwaukee and Racine; T. J. Donovan, Jr., Philadelphia; A. B. Bok, Toledo; J. B. Brierley, (Alternate) Western Mich.

Third Row: G. W. Wise, Twin City; G. M. Morceau, Elmira; F. J. Schmitt, Chicago; F. E. Hardy, Jr., Decatur; J. J. Hogan, Greater N. Y.; E. W. DeBisschop, Rochester; J. W. Lannon, Syracuse and Schenectady; H. E. Peiffer, Cleveland; L. A. Talamini, Golden Gate; L. A. Sheeran, Little Rhody. 4th Row: C. G. Rising, Springfield (Mass.); F. W. McQueston, Worcester; Recorder, C. F. Staples, Pontiac; W. G. Ehrhardt, St. Louis; R. G. Karlen, Erie; H. L. Boese, Indianapolis; G. R. Morin, Twin States; H. C. Will, Baltimore.

Fifth Row: T. L. Kings, Fox River Valley; W. F. Stewart, Montreal; W. B. Moore, Windsor; J. F. Sargent, New Haven; C. B. Christensen, Fairfield Cty.; L. E. Wells, Wichita; J. C. Preston, Houston; P. D. Browne, North Texas; W. H. Vickers, Muncie; R. E. Lockridge, Richmond; A. J. Pangburn, Binghamton. 6th Row: Edmond Morancey, Hartford; G. W. Brown, Atlanta; C. J. Weingartner, Phoenix; J. J. Bemb, Buffalo-Niagara Frontier; W. E. L. Bock, Columbus; D. E. Hawkinson, Rockford; M. H. Kline, Fort Wayne; J. V. Javorsky, Springfield (Ill.).

Seventh Row: J. M. Johnston, Portland (Me.); T. E. Newby, Western Mich.; C. L. Fanning, Flint. Last Row: E. G. Dewar (Alt.) Niagara District; T. C. Bradford, (Alt.) Worcester; M P. Erdmann, Akron; J. J. Demuth, (Alt.) St. Louis; and George Tillotson, (Alt.) Dayton.

Editor F. W. Wilson explains to the Handbook Committee presentation he has prepared for the Exposition, showing development of "Tool Engineers' Handbook." L. to r.: Frank Martindell, Mr. Wilson, A. L. Potter, F. W. Curtis, Chm. E. W. Ernst and R. B. Douglas.

Business . . .

Banquet . . .

DAYS BEFORE the official convention opening, National Committees and administrative groups began meeting at Cleveland.

The House of Delegates, a new body of Chapter representatives, assembled for first time to elect Directors. Present Board chose new National Officers, authorized important enterprises.

The Resolutions Committee screened Board business . . . Education Committee held important session to discuss expanded program . . . Handbook Committee worked out editorial plans . . . new officers held organizational meeting.

The Annual Dinner, Society's "coming of age" party, was a milestone in ASTE history. Address by Packard's President George T. Christopher, an old time tool engineer; international recognition through honors bestowed by Institution of Production Engineers, Great Britain; and installation of National Officers highlighted evening.

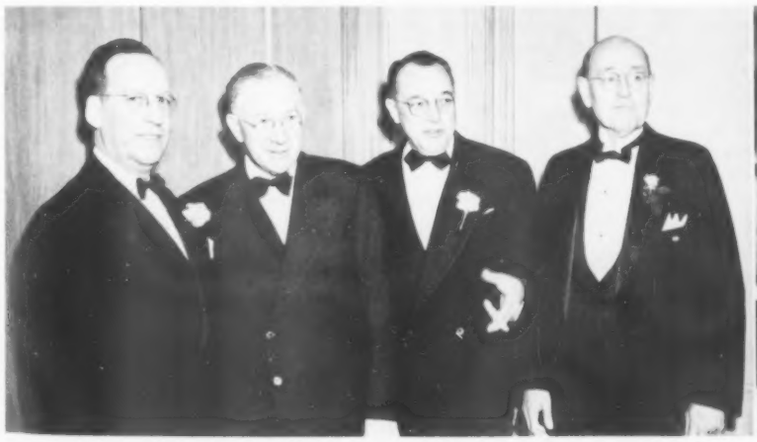
"This ASTE war bonnet, presented by my predecessor with instructions to keep my head inside, is passed along to you with the same admonition," retiring President C. V. Briner charges his successor, A. M. Sargent. Right: "The Tool Engineer is the incubator of the urge of mass production," says George T. Christopher, Packard Motor Car Co. President, speaking of "The Middle Man of Technology" at ASTE Annual Dinner.

Education Chm. O. W. Winter accepts, on behalf of the Society, a hand-painted replica of the armorial coat of arms of the Institution of Production Engineers. E. W. Hancock, I.P.E. Section President, makes presentation of this and Honorary Membership conferred on ASTE President. Right: George Morin of Twin States claims National Membership Trophy recaptured by his Chapter as V. H. Ericson (right), retiring Nat'l Membership Chm., announces perfect score of 3000 points and A. M. Sargent looks on.

National Officers and distinguished guests take their places at President's table. L. to r.: V. H. Ericson, R. B. Douglas, I. F. Holland, T. P. Orchard, W. B. Peirce, Lee C. Howley, Law Director, City of Cleveland; A. M. Sargent, George T. Christopher, guest speaker;

C. V. Briner, E. W Hancock, I.P.E.; A. M. Schmit W. J. Frederick, W. A. Dawson and H. E. Conrad. Right: English and Canadian group chat with Pres. Briner. L. to r.: R. B. Douglas, E. W. Hancock, Mr. Briner and W. A. Dawson.

Below: Attending pre-banquet reception are (l to r.): A. M. Sargent, G. T. Christopher, C. V. Briner and W. B. Peirce. Right: Mr. and Mrs. O. W. Winter (extreme left) with ladies of head table guests. L. to r.: Mrs. E. W. Hancock, Mrs. C. V. Briner, Mrs. G. T. Christopher and Mrs.



A. M. Sargent. Mr. and Mrs. Hancock made special trip from England to attend ASTE New Era Exposition and convention in which Mr. Hancock participated as speaker at one of the educational sessions directed by Mr. Winter, Chairman of the Society's Education Committee.

Pres. Briner is interviewed concerning the future of industry, by Ed Wallace, in a newscast from radio station WTAM. Society officers participated in three such broadcasts during Exposition.

President Briner entertains in honor of ASTE Past Presidents (seated, l. to r.): W. F. Wagner, T. B. Carpenter, W. H. Smila, ("Jim" Scott, "Our Guest" and Past President, NMTBA.) J. A. Siegel, A. H. d'Arcambal, R. H. Morris and O. W. Winter. Standing (l. to r.) are: V. H. Ericson, W. J. Frederick, A. M. Schmit, W. B. Peirce, A. M. Sargent, Mr. Briner, T. P. Orchard, R. B. Douglas, W. A. Dawson, I. F. Holland and H. E. Conrad.

Focal point from entrance to Exposition was this black velvet backdrop epitomizing the Tool Engineer.

Signifying transfer of authority, President Briner hands new ASTE gavel to his successor, A. M. Sargent. Made of cemented tungsten carbide with lucite handle bearing the ASTE emblem, the modern gavel replaces conventional wooden model.

Laughing exultantly as their Detroit rivals (below) are stumped by a tough question, Cleveland "Quiz Kids" win contest, cash and tooth paste in "Quiz of Two Cities," broadcast through WGAR of Cleveland and WJR of Detroit. Cleveland ASTE team is composed of (l. to r.): H. E. Peiffer, Dr. H. B. Osborne, Jr.; E. W. Baumgardner and R. E. Harrold. Detroit contenders are (l. to r.); L. B. Bellamy, Granville Sharpe, Jr.; (Warren Kelly, M.C.); Edward Wiard and G. S. Wilcox, Jr.

Luncheon get-together of Texans is attended by (l. to r.): Miss Margaret Amis, the only woman member in Texas; J. P. Dobson, H. G. Boswell, John Thompson, E. L. Minch, T. A. Hersh, Homer Briggs, J. A. Lapham, P. D. Browne, J. C. Preston, H. B. Young, Donald Mackenzie, H. D. Hall of Newark, N. J.; C. A. Vogt, H. E. Collins, David Crowley, R. E. Hammond and F. E. Doty. Beyond range of camera is L. M. Cole.

Below: Tables are turned when five banquet guests interview the ASTE News hound. L. to r.: James Wright, Vice-Pres. and Gen. Mgr., Morse Twist Drill & Machine Co.; R. B. Powers, Exec. Editor, *The Tool Engineer;* William Kirk, Pres., NMTBA, and V.-Pres., Pratt & Whitney; "Jim" Scott, Pres., Van Norman Machine Tool Co., and Past Pres., NMTBA, John Lindegren, H. C. Hook Co.; and Doris B. Pratt, ASTE News Editor, *The Tool Engineer.*

Sargent Elected to '46-'47 A. S. T. E. Presidency
Houston to Have Next Annual Meeting

CLIMAX OF THE Fourteenth Annual Meeting of the ASTE Board of Directors at Hotel Statler, Cleveland, April 6, was the election of National Officers for the coming year.

A. M. Sargent

Highest office in the Society, was conferred on A. M. Sargent, President and General Manager, Pioneer Engineering & Mfg. Co., Detroit, Mich., who was elected President.

Mr. Sargent succeeds C. V. Briner, Manager, Gage and Tool Div., Pipe Machinery Co., Cleveland, Ohio.

Vice-Presidents Advanced

W. B. Peirce, Vice-President, Research and Development, Flannery Bolt Co., Bridgeville, Penna., was named First Vice-President, with Thomas P. Orchard, Partner and General Manager, American Tool Engineering Co., New York City, as Second Vice-President.

Messrs. Sargent, Peirce and Orchard were advanced from their respective vice-presidencies.

Other officers chosen by the Board are: Third Vice-President, Irwin F. Holland, General Superintendent, Small Tool and Gage Dept., Pratt & Whitney, Div. Niles-Bement-Pond Co., West Hartford, Conn.

Secretary, R. B. Douglas, Works Manager, Propeller Div., Canadian Car and Foundry Co., Ltd., Montreal, Que.; and Treasurer, V. H. Ericson, Vice-President, Johnson-De Vou, Inc., Boston, Mass.

When elected, Mr. Holland was the incumbent Constitution and By-Laws Chairman; Mr. Douglas, a National Director; and Mr. Ericson, National Membership Chairman.

W. A. Dawson, Branch Manager, F. F. Barber Machinery Co., Hamilton, Ont., was re-elected Asst. Secretary-Treasurer.

The Nominating Committee submitting the slate of candidates was chairmanned by Ray H. Morris. Members of his committee were: F. W. Eaton, K. C. Jasper, G. J. Hawkey, and L. G. Singer.

On the same day, the first House of Delegates, a recently-created body composed of representatives from the various Chapters, met to elect the 1946-47 Board of Directors.

Board-Elect Meets Next Fall

The new Board, which takes office at the Semi-Annual Meeting in October, will consist of Messrs. Sargent, Peirce, Orchard, Holland and Douglas; C. B. Cole, Owner, Tool Equipment Sales Co., Chicago, Ill.; H. E. Collins, Production Engineer, Hughes Tool Co., Houston, Tex.

A. J. Denis, President, Murphy-Denis Corp., Los Angeles, Calif.; A. M. Schmit, Owner and General Manager, A. M. Schmit Co., Toledo, Ohio; and Grant S. Wilcox, Jr., Asst. Master Mechanic, Plymouth Div., Chrysler Corp., Detroit.

Mr. Briner, the retiring President, continues in office as Director for another year.

Much important business, concerning the many phases of the Society's activities, was also executed by the Board. Clearing of the entire agenda during an afternoon and evening session was facilitated by the painstaking work of the Resolutions Committee. In its meeting the previous day, this committee screened the business to be considered by the Board and recommended action thereon.

Serving on the Resolutions Committee were I. F. Holland, Chairman, and Directors R. B. Douglas, W. J. Gamble, K. C. Jasper, Hallet D. Jones and H. R. Shearer.

President Gives Full Report

In his extensive report of the year's activities, President C. V. Briner reviewed for the Board the accomplishments of the administration.

Calling attention to the Society's recognition by industry, he cited recent editorial comments appearing in various publications.

His recommendation that the Society engage a full-time public relations counsel attached to the National Headquarters staff was approved by the Board.

A 12½% average increase in editorial and advertising contents of *The Tool Engineer*, despite unsettled conditions in industry, labor and advertising and a continued paper shortage, was reported by National Editorial Chairman G. J. Hawkey.

Page content of the March, 1946, pre-Exposition issue rose 50%, he pointed out. Efficient operation of the staff, smallest of any comparable publication; successful introduction of the symposium type of technical article, and the gradual development of good reporters among Chapters making regular news contributions were also discussed in Mr. Hawkey's report.

New Program Committee Setup

Organization of the National Program Committee, with complete details for its operation and structure, was reported by Chairman H. D. Hall, who had charge of the Cleveland convention program.

A directory of technical speakers and subjects, sources of visual aids and general interest speakers is to be made available to Chapters and kept up-to-date by this Committee. Their recommendations include the establishing of a library of program information at National Headquarters.

Years of missionary work on the part of National Education Chairman O. W. Winter culminated in the granting of a substantial appropriation to expand the vital function of advancing tool engineering education.

With ample financial backing, the Committee can launch its program of initiating degree courses in Tool Engineering, subsidizing competent professors, preparing adequate textbooks, motion pictures and slides.

Other projects contemplated in the educational field include encouraging industry to contribute equipment and samples to school shops and to provide inspection trips and co-operative or summer employment.

An active and controlled research pro-

C. V. Briner

W. B. Peirce

W. A. Dawson

T. P. Orchard

I. F. Holland

R. B Douglas

National Officers and Incoming Board of Directors

H. E. Collins

G. S. Wilcox, Jr.

A. J. Denis

V. H. Ericson

A. M. Schmit

C. B. Cole

gram was also urged to help establish Tool Engineering as an engineering science.

Chairman Winter commended the efforts of individual Chapters in sponsoring educational programs, local Tool Engineering courses, thesis and scholarship awards, as well as junior and apprentice programs.

Procedures Prepared

Constitution and By-Laws Chairman, I. F. Holland announced that procedures governing duties and functions of elected and appointed officers and other Society operations had been prepared by the Organization Progress Committee before its dissolution.

The printed procedures, revised and edited by the Constitution and By-Laws Committee, are now being distributed to officers throughout the Society.

This Committee will make an annual revision and distribution of the various instructions designed to supplement, clarify and interpret the intent and practical application of the new Constitution and By-Laws.

Standardization Program

Activities being plotted by the National Standards Committee, according to Chairman W. H. Smila, include a standardization program with Chapter participation, the monthly publication of four pages of engineering data in *The Tool Engineer*, and a new indexing system for numbering data sheets by product or data classification.

Under consideration, too, is the preparation of data sheets on old model machines, with the machine builder cooperating in issuing a sheet for the corresponding current model. Plans are under way to issue sheets for recording machine data as masters for making blueprints.

Data sheets furnished by Canadian manufacturers for Canadian consumption are to be published and distributed in that country.

A resolution recommending Society representation in the Canadian Standards Association was adopted.

A total of 802 new members admitted since September was recorded in the report of National Membership Chairman V. H. Ericson.

The heavy loss of membership, anticipated with the cutback in war production, has not materialized, the net decrease of 792 leaving a total membership of 17,413 as of February 28.

New Membership Information Booklet

With a perfect score of 3000 points, Twin States Chapter again carried off the National Membership Trophy. This live-wire group, located in the Green Mountains of Vermont, first captured the cup two years ago.

A new information booklet, published by the Membership Committee, explains to prospective members the Society's purpose, aims, services and activities.

Steady progress on the production of the "Tool Engineers' Handbook" was indicated in the report of Chairman E. W. Ernst. Manuscripts are being checked from various angles by several committees working with Editor Frank W. Wilson.

An exhaustive study to determine a system for suitably recognizing outstanding contributions of individuals to the profession of Tool Engineering was apparent in Chairman R. B. Douglas' report of the activities of the new Honor Awards Committee.

Two types of awards are to be instituted: one for achievement or outstanding merit, and another for contributions to technical literature.

The awards may be medals, cash, certificates, scholarships or fellowships and may be privately endowed as memorials.

In line with the recommendations of Budget Director H. E. Conrad, a substantially higher budget was submitted by Finance Chairman F. W. Eaton.

Unforeseen developments necessitating the additional appropriation were the continuing high level of membership and unavoidably increased expenses.

Annual Directory Authorized

The A.S.T.E. Directory, now in production, is to become a yearly enterprise as the thirteenth issue of *The Tool Engineer*, as recommended in the report of Chairman Wayne Kay.

Extension of the closing date makes it possible to include listings of new National and Chapter Officers. Distribution of the book is expected in July.

Adoption of a Society Code of Ethics and a Tool Engineer's Pledge was approved by the Board. The 11-point code and the professional pledge are to be reproduced on one 12" x 18" sheet, suitable for framing, and presented to each member of the Society.

Houston to Be '47 Host

Selection of Houston, Texas, as the location for the 1947 Annual Meeting was made on the recommendation of Time and Place Chairman L. J. Radermacher and his committee members, E. M. Seifert and Howard Volz.

In closing the meeting, President Briner told the Board, "You have changed the complexion of the ASTE. Without your support, many of these projects would have fallen of their own weight."

Improved Methods Point Way to Cost Reduction

NEW TECHNIQUES, in fields from plant layout to quality control and from engineering training to engineering for profits, were discussed in the nine symposia conducted by the National Program Committee, under the direction of Chairman H. D. Hall, at the Society's Fourteenth Annual Meeting in Cleveland, April 8-12.

"Plant Layout for Efficient Materials Handling," the Monday afternoon topic, was planned to give the tool engineer a working knowledge of this subject.

Savings in Efficient Layout

Improvements in the layout of plants and in methods of handling materials offer the most lucrative source of economy in manufacturing today, Haylett B. Shaw, Staff Engineer, Methods Engineering Council of Pittsburgh, stressed in his address.

Material handling, amounting to 22% of the labor cost, is the greatest single item entering into present-day production he pointed out.

Modern handling equipment, building design, wage incentives, flow charts, and selection of qualified personnel were all treated in Mr. Shaw's discussion.

Otto F. Ewert, Vice-President and General Manager of the Ordnance Div., W. F. & John Barnes Co., Rockford, Ill., related his company's experience in mass producing ammunition with specialized machinery.

"Dislocations," Mr. Ewert said, "that may occur in one application, as far as personnel is concerned, are soon taken care of by the requirements that are created in other applications. Production begets production — production begets jobs."

A new approach to a determination of the facilities and manpower required for a specific manufacturing project was introduced by A. W. Kramer, Jr., Engineer in Special Assignments, Air Conditioning Dept., General Electric Co., Bloomfield, N. J.

Studying factories by lines, Mr. Kramer explained, leads to solutions of problems involving size, capacity, location, operating organization, and total capital lockup required for a plant to produce a given line.

Chairman for the session was W. B. McClellan, Sales Engineer, Gairing Tool Co., Detroit.

Controlling Quality

Technical subject for the evening symposium was "Economic Control of Quality." The speakers were presented by Stephen Urban, Tool and Gage Engineer, Pratt & Whitney, Div. Niles-Bement-Pond Co., Rochester, N. Y.

E. S. Marks, Quality Engineer, Pratt & Whitney Aircraft, East Hartford, Conn., emphasized the need for organization of manufacturers' specifications, often scattered in cost and production records, in shop correspondence, and in the minds of shop executives.

Fundamentals of inspection procedure were discussed by A. L. Davis, Associate Director, Evening School and Extension Div., Rochester Institute of Technology, Rochester, N. Y.

Purposes of Inspection

The four major functions of an inspection or quality control organization, as listed by Mr. Davis, are: providing protection, maintaining product control, portraying quality performance, and educating and training personnel in matters of quality.

J. G. Manuele, Director of Quality Control, Westinghouse Electric Corp., East Pittsburgh, Pa., analyzed the relation of statistical background to quality control.

Statistical sampling procedures, control charts and the reduction of manufacturing, inspection and operating costs, utilizing the statistical technique, were described by the speaker.

Choice of Method

Final phase of the subject, "Dimensional Control," was presented by P. V. Miller, Manager, Small Tool and Gage Div., Taft-Peirce Mfg. Co., Woonsocket, R. I. Mr. Miller offered solutions to the problem facing the engineer in choosing the method of inspection or type of inspection device permitting the greatest

economy while giving suitable control of quality in the product.

Tuesday afternoon, several authorities collaborated in a Cutting Fluid symposium conducted by F. J. Schmitt, Sales Manager, D. A. Stuart Oil Co., Chicago, Ill.

D. J. Wangelin of the Research and Development Laboratories, The Pure Oil Co., Chicago, read a paper dealing with various methods of evaluating cutting fluids under actual metal cutting conditions. He pointed out how the type of procedure to be followed in testing cutting fluids is influenced by the particular interest of the user.

Cutting Fluids Affect Tool Design

Pertinent points brought out by W. H. Oldacre, President and General Manager, D. A. Stuart Oil Co., Chicago, included the cutting fluid factor in designing tools, its relation to tool design and performance, and the increase in overall efficiency through consideration of the cutting fluid element.

Commentators discussing these papers were Joseph Geschelin, Founder and Chairman, Independent Research Committee on Cutting Fluids, and Detroit Editor, Chilton Co.; F. W. Lucht, Development Engineer, Carboloy Co., Detroit, and A. H. d'Arcambal, Vice-President — Consulting Metallurgist, Small Tool and Gage Dept., Pratt & Whitney, Div. Niles-Bement-Pond Co., West Hartford, Conn.

Speaking on the evening program, "New Techniques in Cutting Tools," Mr. d'Arcambal commented on his recent inspection tour of German war plants, observing that the Reich surpassed us in utilizing substitutes for scarce materials. American research, products and output are superior to Germany's, however, he added.

Carbide Cutting Experiments

J. F. Allen, Project Engineer, The Warner & Swasey Co., Cleveland, reported results of an experimental program conducted by his company to determine how fast metal can be removed and how much power is required when carbide cutters are operated under closely-controlled conditions.

An educational symposium in two panels, sponsored by the ASTE National Education Committee, highlighted Wednesday's schedule.

First speaker introduced by Chairman O. W. Winter, Vice-President, Acme Pattern & Machine Co., Buffalo, N. Y., was O. B. Jones, the Society's Founder and Historian, who is President of the Detroit College of Applied Science.

Mr. Jones outlined the intensive, practical, and successful courses in tool engineering which he has developed. Only requirement of a tool engineering course, he said, is that the graduate be tooled up, not just to earn a living, but to earn a living as a tool engineer.

University Research

Prof. O. W. Boston, Chairman, Department of Metal Processing, College of Engineering, University of Michigan, discussed "Research in Tool Engineering," outlining the procedure and equipment used in carrying out investigations dealing with subjects associated with tool engineering.

Professor Boston emphasized the machinability of metals, tools and cutting fluids, as evaluated by turning, milling, drilling and grinding, to show the value of these investigations to the tool engineer and to production.

A five-year course of study, including broadening cultural subjects, was urged for tool engineering students by Dean C. E. MacQuigg of the College of Engineering, Ohio State University.

E. W. Hancock, Works General Manager, Rubery, Owen & Co., Darlaston, South Staffordshire, England, detailed the educational program of the Institution of Production Engineers of which he is a section president.

England to Modernize Industry

Modernization of British industries, under government sponsorship, he said, will give the production engineer an opportunity to revitalize them for the benefit of the entire nation.

In the concurrent afternoon session, H. O. Poock, Asst. Master Mechanic, Inland Mfg. Div., G.M.C., Dayton, and K. T. Kuck, Chief Engineer, The Monarch Machine Tool Co., Sidney, Ohio, treated various applications of "Tooling for Permanent Molds."

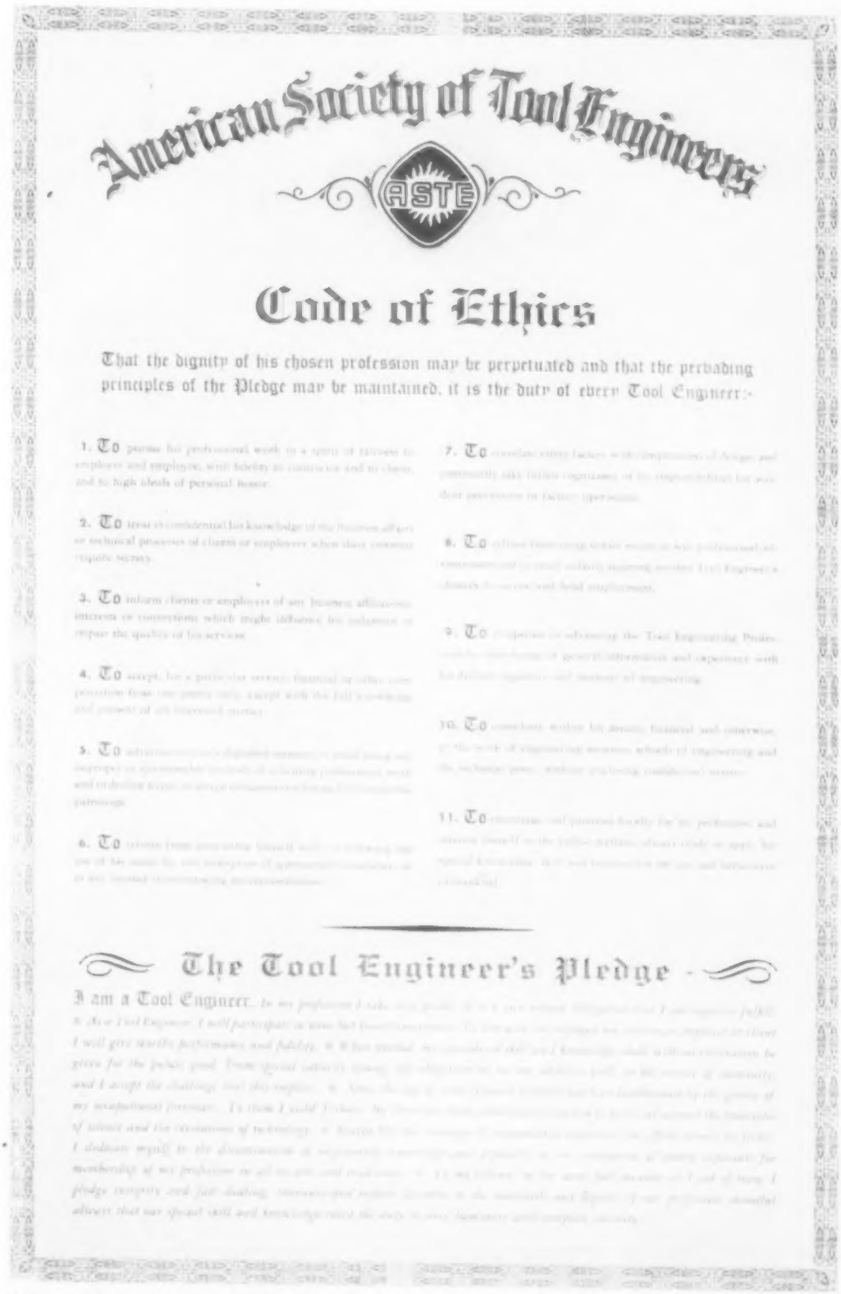
Mr. Poock illustrated with motion pictures his address, "Permanent Molds for Rubber and Plastics." Questions from the floor were answered by four experts from his staff.

An intricate mechanism for machining molds with as many as 500 flutes was described and illustrated by Mr. Kuck in discussing, "Shape Turning on a Lathe for Molding Glass and Other Materials."

Session Chairman was Earl V. Johnson, President, The Dayton Carbide Tool Co., Dayton, Ohio.

Machine Will Pace Operator

The ultimate trend in machine tool design is toward a machine that paces the worker, was the prediction of Ralph E. Flanders, President of Jones & Lamson Machine Co. and Bryant Chucking Grinder Co., Springfield, Vt. Mr. Flanders was a speaker at the Thursday after-


American Society of Tool Engineers

ASTE

Code of Ethics

That the dignity of his chosen profession may be perpetuated and that the prevailing principles of the Pledge may be maintained, it is the duty of every Tool Engineer:-

1. To pursue his professional work in a spirit of fairness to employers and employees, with fidelity to contracts and to client, and to high ideals of personal honor.

2. To treat as confidential his knowledge of the business affairs or technical processes of clients or employers when their interests require secrecy.

3. To inform clients or employers of any business affiliations, interests or connections which might influence his judgment or impair the quality of his services.

4. To accept, for a particular service, financial or other compensation from one source only, except with the full knowledge and consent of all interested parties.

5. To [illegible] patronage.

6. To [illegible] his employer.

7. To [illegible] and personally take definite cognizance of the responsibilities for safe and healthful conditions in factory operations.

8. To [illegible] and to avoid unfairly injuring another Tool Engineer's chances to secure and hold employment.

9. To [illegible] and experience with his fellow engineers and members of engineering.

10. To [illegible] and otherwise in the work of engineering societies, schools of engineering and the technical press, without prejudicing confidential matters.

11. To [illegible] and personal loyalty for his profession, and interest himself in the public duties of every citizen, so that his special knowledge of the uses and limitations of engineering may be available for the use and benefit of humanity.

The Tool Engineer's Pledge

I am a Tool Engineer. In my profession I take [illegible] As a Tool Engineer, I will participate in [illegible] I will give quality performance and fidelity. In all [illegible] and I accept the challenge that this implies. As [illegible] of my professional practices. To this I solemnly pledge [illegible] I dedicate myself to the accomplishment of [illegible] membership of my profession in all its aims and ideals [illegible] pledge integrity and fair dealing [illegible] allowed that our special skill and knowledge [illegible]

ASTE members will soon receive this official Society Code of Ethics and Tool Engineer's Pledge, recently authorized by the Board of Directors. The 12" x 18" reproduction is in blue and gold.

noon session, "Profit Producers for Industry."

Even if machine tool costs rise, he indicated, consumer goods prices would not be raised, because the new high output tools will increase production and help avert inflation.

Tooling for Profit

Relationship of the present trend of wages, prices and costs to the use of highly productive machinery, and the profit possibilities of intelligent applications of machine tools to present-day shop operations were stressed by A. G. Bryant, Vice-President, Cleereman Machine Tool Co., Chicago.

Defining the elements constituting our national economy — natural resources, man and wealth, C. E. Ives, Owner, Ives Engineering and Planning Co., Chicago, introduced his subject, "Relationship of Tool Engineering to Economics."

In developing his theme, he enlarged upon the five "M's" involved in the production of wealth—Management, Manpower, Money, Materials, and Machinery. Mr. Ives explained the correlation of these factors by the tool engineer for producing greater national wealth.

H. E. Linsley, Machine Tool Editor, *The Iron Age*, New York City, served as Chairman for the meeting.

The Friday afternoon concluding session featured "Controls and Drives for Special Machine Design."

Modern methods of applying hydraulic power operation to various types of motions and machines highlighted the address of L. R. Twyman, Manager of the Industrial Div., Vickers, Inc., Detroit. Mr. Twyman outlined new trends in the use of hydraulic controls developed during the war and application methods which have not yet become universally known.

Variable Speed Devices

L. A. Trofimov, a well-known Cleveland consulting engineer, lectured on "Mechanical Variable Speed Transmissions," enumerating and explaining five known principles upon the basis of which variable speed devices can be made.

Slides illustrated the devices developed around gear change or sliding gear transmission, cones-and-belt, disc and roller, and the variable-throw and inertia type torque converters.

New trends in electrical equipment for machine tools, including the use of electronics, formed the basis of the talk by G. A. Caldwell, Manager, Control Engineering Dept., Westinghouse Electric Corp., East Pittsburgh, Pa.

B. P. Graves, Director of Design, Brown & Sharpe Co., Providence, R. I., completed the symposium with a paper on "Drives and Controls on Standard Machines, and Special Adaptations."

Slides Illustrate Controls

Mr. Graves showed slides illustrating mechanical, electrical, hydraulic and pneumatic drives, explaining the purpose of each design and the reason for its adoption.

Chairman E. W. Baumgardner, Machine, Tool and Die Designer, National Carbon Co., Cleveland, presided over the meeting.

Certificates of Appreciation were presented to each technical speaker appearing in the convention program.

"Be Inconsistent," Christopher Tells A.S.T.E.'ers

TERMING TOOL ENGINEERS "the life of the party," George T. Christopher, President, Packard Motor Car Co., Detroit, described their profession as "the incubator of the mass production urge," in a speech before the ASTE Annual Dinner at Hotel Statler, Cleveland, April 11.

"This is one field," Mr. Christopher continued, "where teen-agers cannot crash the gate. You simply have to have 'old man experience' in the hip pocket."

"Middle Man of Technology"

In developing the three controlling factors of industry—producing to specifications, constant improvement of product, and maintenance of company reputation, the tool engineer, he pointed out, is "the middle man of technology."

As soon as the shop is able to carry out the design specifications, the designer expects greater perfection, Mr. Christopher said. And with more exacting production demands, come new gages and equipment to check these requirements more precisely, he added.

"Tools cost money," he conceded, "but if you get enough production, they're the cheapest things in the place."

In closing, Mr. Christopher commented, "A qualified tool engineer must be inconsistent—if he has too much respect for his first idea, he will never accomplish what is possible."

Mass-Produced Rolls-Royce Engine

His familiarity with production problems, in rising from shop to top, was demonstrated during the war in his approach to the mass production of the Rolls-Royce engine which other industrialists said could not be built in volume.

The conspicuous success of this achievement has prompted the Government to retain Packard's services for peacetime research in the field of aircraft and marine engines.

The next speaker, E. W. Hancock, Section President of the Institution of Production Engineers, Great Britain, and Works General Manager, Rubery, Owen & Co., Ltd., Darlaston, South Staffordshire, England, brought greetings from his country.

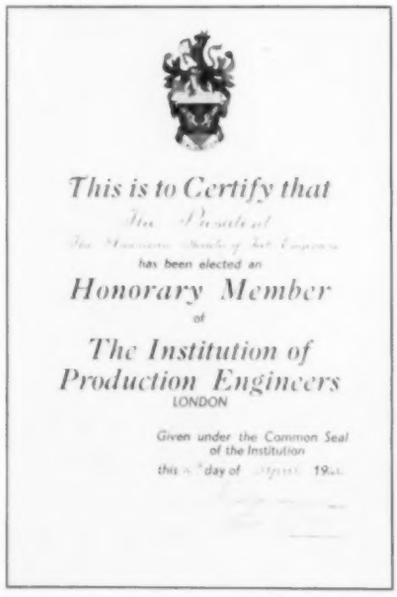
"The good will expressed in a meeting of ordinary 'blokes' like me and ordinary fellows like you," he said, "can do more good than all the written agreements between nations."

People who have gone through the difficulties of hard work and rebuffs can get together because they have a common understanding, Mr. Hancock stated.

"The real people of Great Britain," he continued, "think that the real people of America are the real people."

Commenting on the New Era Exposition, he said, "You have stimulated people to feel that 'here we go again,' that this is the start of the flywheel that will lead to great peace and plenty. These are good signs—the Exposition is a symbol."

As a gesture of good will and professional recognition, Mr. Hancock presented to President C. V. Briner an Honorary Membership in the Institution of Production Engineers, to be held by "the ruling President of ASTE." Only three such memberships have been granted by the IPE.



This Honorary Membership in the Institution of Production Engineers, Great Britain, was bestowed on "the ruling President of ASTE" during Annual Dinner at Cleveland. E. W. Hancock, President, Wolverhampton Section of IPE, made presentation. Mr. Hancock came to America to participate in an educational session at the ASTE convention. Document was accepted by retiring President C. V. Briner, later transferred to incoming President A. M. Sargent. Only three such memberships have been awarded by IPE.

Presents Coat of Arms

Mr. Hancock also presented to Education Chairman O. W. Winter, on behalf of the Society, a framed, hand-painted replica of the armorial coat of arms of the IPE, accompanied by letters conveying good wishes from Sir Robert MacLean, President, IPE, and A. G. B. Owen, Chairman of the Board, Rubery, Owen & Co., Ltd.

National Secretary A. M. Schmit and National Treasurer W. J. Frederick made their annual reports to the membership. Both reports indicated progress and stability.

President Briner, before installing the new officers, paid tribute to the outgoing administration and its achievements, concluding, "I have been gloriously overpaid in the friendships I have been given this year."

Using for the first time the impressive oath of office composed by the Organization Progress Committee as part of the new operational procedures, President Briner inducted the 1946 National Officers.

Those installed were: A. M. Sargent, President; W. B. Peirce, First Vice-President; T. P. Orchard, Second Vice-President; I. F. Holland, Third Vice-President; R. B. Douglas, Secretary; V. H. Ericson, Treasurer; and W. A. Dawson, Assistant Secretary-Treasurer.

Tungsten Carbide Gavel

Tossing aside the battered wooden gavel that had served the Society since its organization, Mr. Briner presented to President Sargent a streamlined model with cemented tungsten carbide head and a lucite handle bearing the ASTE emblem.

A humorous note was struck, at the otherwise dignified function, when Mr. Briner passed along to President Sargent the "ASTE war bonnet." The "bonnet" was a hat originally presented to the former by his predecessor, Ray H. Morris, with advice "to keep your head

inside for the rest of the year." Mr. Sargent got the same admonition.

Transfer of the IPE Honorary Membership and coat of arms to President Sargent's custody completed the ceremonies symbolizing the changeover of administration.

"Graduation Day" Ceremonies

In his inaugural address, President Sargent said, "I feel deeply humbled, despite the fact that you have elected me President of ASTE, the greatest engineering society in the world."

"These ceremonies have been symbolic of graduation day, ending an apprenticeship of 14 years for every individual member of this Society wherever he may be.

"Our predecessors," he added, "have set a high standard for those who follow. Mr. Briner met more difficult problems than any other President. ASTE will remember him as a great leader and a great President."

Presenting Mr. Briner's Life Membership, bestowed on retiring Presidents, Mr. Sargent said, "All of us owe him a debt of gratitude which we can never repay."

Will Promote Society Program

The new officers, he asserted, would strive to continue the Society's program as part of an important profession. No other profession, he summarized, is so large a part of the daily life of every man, woman and child.

New England Group Wins Trophy

Awarding of the National Membership Trophy to Twin States Chapter completed the evening's program. V. H. Ericson, retiring Membership Chairman, presented the cup to George Morin, the Chapter's 1945 Chairman.

With a membership of 201 recruited primarily from a town of 8,000 population and one smaller community, Twin States Chapter, located at Springfield, Vt., turned in a perfect score of 3000 points in last year's Annual Trophy competition.

More than 700 members and guests attended the banquet and witnessed the installation ceremonies.

New Techniques Observed in Cleveland Plants

ONE OF THE most popular features of the Exposition and convention was the schedule of conducted tours through Cleveland plants.

During the week 35 chartered buses carried 1442 visitors on 22 trips to nine factories. Nearly twice as many show registrants would have participated had it not been necessary for the plants to establish quota limitations.

Aircraft Engine Research

Unusual attraction was the opportunity to visit the Aircraft Engine Research Laboratory of the National Advisory Committee for Aeronautics at Cleveland Airport.

The Laboratory is one of three such NACA research centers, providing basic information for aircraft engine designers and manufacturers.

Nearly 100 laboratories for studying all elements of aircraft power plants are contained in the 5½-acre Engine Research Building alone.

Research is conducted in engine performance and materials, compressors and turbines, fuels and thermodynamics, wind velocities, air pressures, and icing conditions.

Large refrigeration machines, air pumps, exhaust gas coolers and evacuators duplicate any condition likely to be encountered in flight.

Electronic Controls

At Reliance Electric & Engineering Co., the ASTE groups found the many applications of electronics to machine controls of especial interest.

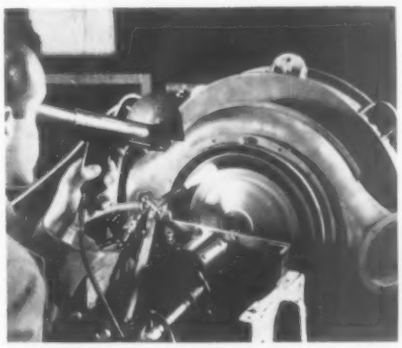
Each type of machine offers different problems in the design of the proper drive. The delicate function of hosiery knitting machines calls for electronic precision in a drive providing complete automaticity of operation. Such rugged machines as steel rolling mills, huge stamping presses, and mining equipment call for large quantities of controlled power in a driving arrangement designed to "take it."

Automatic Screw Machinery

National Acme Company was host at several tours where multiple-spindle, bar and chucking automatics, Chronolog time controllers, automatic threading dies and taps and special screw machine products were in production.

Warner & Swasey guests saw special tooling setups being tested before shipment. A high point in the shop tour was the inspection of their newly-designed, 5-spindle automatic machines. Revolutionary textile machinery, designed to bring this industry into the high production-low cost field, is another Warner & Swasey innovation.

Outstanding feature of the trips to The Ohio Crankshaft Company was the Tocco Induction Heating Laboratory, considered one of the most complete of its kind. A 7-station multiple test unit is used for experimental work on small and medium-sized parts, in addition to heating fixtures for special jobs and standard units for production-type experimental work.



New heat-resistant materials for gas turbines are constantly being sought at the Aircraft Engine Research Laboratory of the National Advisory Committee for Aeronautics, Cleveland. Turbine efficiencies increase with operating temperature. Here, an experimental temperature-indicating instrument is checked for accuracy.

Induction brazing of carbide tips was demonstrated, along with induction hardening, annealing and heating.

Truck Building

New 1946 trucks and buses were exhibited at The White Motor Company where experience gained in designing and manufacturing military units is being applied to the building of civilian vehicles.

Improvements include an automatic transmission, better lighting, ventilation and spring suspension and a separate accessory unit. Generator, air compressor and fans are separated from the underfloor engine and operated through a separate drive, eliminating all belts.

At Clark Controller Company the engineers had opportunity to study the various electrical and mechanical brakes, contactors, motor starters, controllers and accessories being manufactured.

Techniques in making automotive, aviation, Diesel, marine and industrial bearings and bushings were observed at The Cleveland Graphite Bronze Company, while interesting operations in the development of automotive and stationary storage batteries were demonstrated during the Willard Storage Battery Company open house.

Technical Films

For those who could not be accommodated on plant tours, three daily programs of industrial films, shown in separate theaters at the Auditorium, provided first-hand technical data on a wide variety of manufacturing processes.

Efficient but unobtrusive, the work of the Host Chapter Committees was an important factor in the smooth conduct of the various show and convention activities. These committees staffed an office in the Auditorium for the convenience of visitors, throughout the Exposition, in addition to handling many physical arrangements.

Local Committees

Cleveland members who headed the committees are: General Chairman and Meeting Arrangements, R. E. Harrold, Process Engineer; Plant Tours, H. E. Peiffer, Mechanical Engineer, both of Cleveland Duplex Machinery Co., Inc.; Reception, R. W. Miller, Sales Engineer, Columbia Tool Steel Co.

Banquet, J. R. Fitzsimmons, Partner, Die Supply Co. of Cleveland; Accommodations, William Reiff, Jr., Partner, Garco Machinery Co.; Technical Films, E. W. Baumgardner, Machine, Tool, and Die Designer, National Carbon Co.; and Signs, J. H. Schron, Vice-President, Glenn Tool Co.

The National Public Relations Committee, under the direction of Chairman A. F. Denham, operated a press room, issued releases, conducted press conferences for distinguished speakers appearing on the convention program, and made arrangements for eight radio broadcasts during the week.

As a result of their efforts the Exposition and convention received wide publicity in trade publications and newspapers and over the air.

The Tool Engineer issued the *Exposition Daily*, a tabloid containing registrations and news of the day's events.

National Headquarters manned the registration desk, issued badges and programs. A staff from the Detroit offices also served as attendants at the Society's booth.

A.S.T.E. NEWS

NEWS OF INTEREST AND ABOUT MEMBERS

U. S. Production, Research Superior to German

AMERICAN PRODUCTIVITY, conservatively estimated to be double the German rate, combined with advanced research, more than offset the Germans' resourcefulness in utilizing substitutes for scarce materials, A. H. d'Arcambal told Boston Chapter, at their second Annual Executives Night in Hotel Bradford, March 12.

Mr. d'Arcambal, who is Vice-President-Consulting Metallurgist, Pratt & Whitney, Div. Niles-Bement-Pond, West Hartford, Conn., and a Past President of ASTE and ASM, was relating his observations during a recent inspection of German war plants as a member of a government-sponsored technical investigation committee.

Dispersal of their plants to remote towns enabled the Germans to maintain war production despite Allied bombings, Mr. d'Arcambal continued. Most of the underground plants were undamaged, and are now producing tools and gages in great quantities.

A ball-bearing plant he visited was located in a gypsum mine, heated and air-conditioned. Equipped with more than $5,000,000 worth of machine tools, the factory was largely manned by slave labor.

Research in the United States, Mr. d'Arcambal said, was so far ahead of Germany's that little technical knowledge was gained in the postwar tour of the Reich.

Their tungsten, Mr. d'Arcambal reported, was used primarily as tungsten carbide. While 18-4-1 was the standard high speed steel at the beginning of the war, by 1945 it contained only about 2% tungsten and had very little red hardness.

Production Must Be Supervised

German industry generally, Mr. d'Arcambal concluded, is set to go, but it will require supervision for a number of years in his opinion.

Hon. Jarvis Hunt, Past President of the Massachusetts Senate and Legal Advisor of the Associated Industries, spoke briefly, commending the tool engineer for his contribution to the war effort.

Tool engineers, Mr. Hunt said, would maintain their position by guiding industry through the new period of expansion, overcoming the threat of cheap foreign labor.

Gov. Maurice J. Tobin extended the greetings of the Commonwealth. He recognized the tool engineer and the skilled labor of New England as important factors in keeping this section in the industrial picture.

Ray H. Morris, Past President of ASTE representing President C. V. Briner, discussed the work of the Society and outlined its operation under the new Constitution.

Installation of Boston Chapter officers was conducted by Mr. d'Arcambal. The new officers are: J. B. Savits, Chairman; J. X. Ryneska, First Vice-Chairman; W. W. Young, Second Vice-Chairman; W. C. Swanson, Secretary; and A. J. Leone, Treasurer.

The function was attended by 425 members and guests.

Because of the special section required for reporting the New Era Exposition and Annual Meeting, and the extensive news material submitted by new Editorial Chairmen, publication of other Chapter news received for this issue is being deferred until June.

This is being done instead of condensing all Chapter reports to fit the space available.

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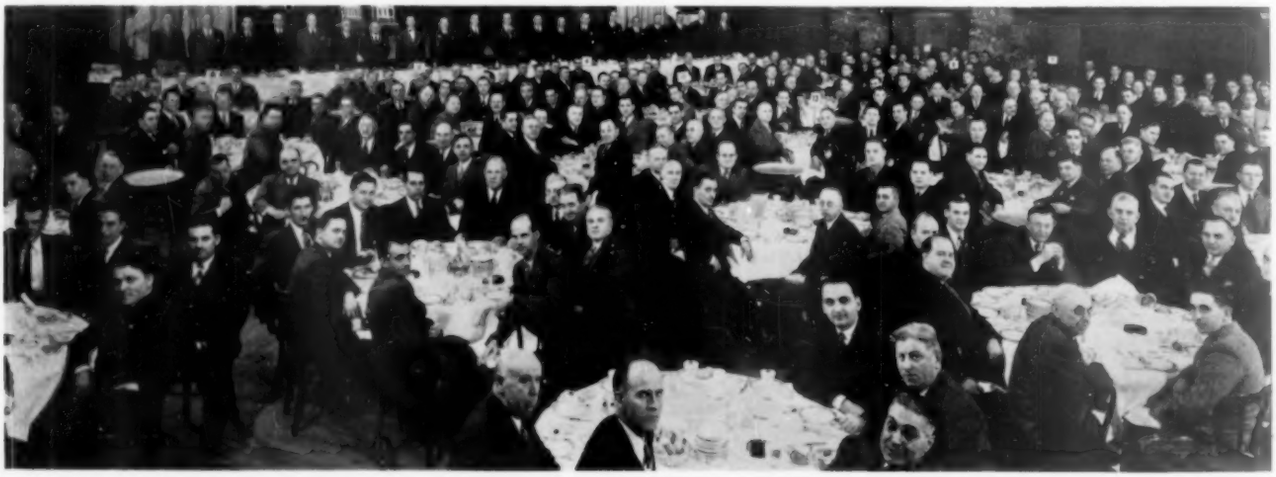


Boston Chapter's Second Annual Executives Night, held March 12 in Hotel Bradford, drew an attendance of 425. Standing at the speakers table are (left to right): Major Burley, host to Past Pres. A. H. d'Arcambal in Germany; W. W. Young, ASTE Director and Chapter 2nd Vice-Chm.; J. A. Morrison, Mgr., Convention Bureau, Boston Chamber of Commerce; Arthur Green, Bay State Abrasive Co.; Henry K. Spencer, Blanchard Machine Co.; L. H. Marshall, Pres., Raytheon Mfg. Co.; K. A. Munson, Mech. Supt., General Electric Co., River Works, Lynn; J. X. Ryneska, 1st Vice-Chm.; Hon. Jarvis Hunt, Legal Advisor, Asso. Industries of Mass.; Arthur A. Nichols, retiring Chm. and Toastmaster; A. H. d'Arcambal, principal speaker, Pratt & Whitney; Ray H. Morris, Past Pres., ASTE; J. B. Savits, '46 Chm.; Ray M. Hudson, Ind. Exec., New England Council; William T. Alexander, Dean of Eng'g, Northeastern University; Carl Tischendorf, Head of Machine and Tool Dept., Wentworth Institute; Prof. Albert Haertlein, Eng'g Societies of N. E.; A. T. Warman, Chm., Worcester Chapter; W. E. Farrell, Chm., Twin States Chapter; and Wilfred Pender, 1st Vice-Chm., Little Rhody Chapter.

Communistic Experiments In U. S. Unsuccessful

Hartford, Conn.—Swearing in of the newly-elected officers by the retiring Chairman, George Highberg, and a forceful, interesting lecture, "Voluntary Economic Methods versus Compulsory Economic Systems," by Erik Oberg, Editor of *Machinery*, highlighted the March meeting of Hartford Chapter at the technical session in the Hartford Gas Company Auditorium.

Erik Oberg

Mr. Oberg, addressing a capacity audience, pointed out that there have been more communistic experiments put into actual practice in the United States than in any country in the world.

These experiments were neither successful nor permanent, he explained, because they were voluntary and men were free to quit whenever they pleased.

"It is interesting to note that the men who have stood on street corners preaching communistic blessings show no avid desire to partake of these blessings by going to Russia to live under them," he added. [The complete text of Mr. Oberg's address appears in this issue, beginning on Page 18.]

Installed with Chairman Edmond Morancey were: First Vice-Chairman, Richard Smith; Second Vice-Chairman, William Jarvis; Secretary, Robert Edmonds and Treasurer, Clayton Parsons.

Preceding the address by Mr. Oberg a dinner was served at the City Club for approximately 100 members and invited guests.

Coming Meetings

DAYTON—June 10, Engineers Club. Speaker: J. I. Karash, Reliance Electric & Engineering Co., Cleveland, Ohio. Subject: "A Method of Reasoning."

FOX RIVER VALLEY—May 21. Speaker: Roger Waindle, Constitution and By-Laws Chairman. Films: Jewel bearing manufacturing; sapphire and engineering materials.

TOLEDO—June 12, Highland Meadows Clubhouse, Sylvania, Ohio. Golf tournament, dinner and entertainment.

Director Frank Martindell pins Chairman emblem on H. J. Braun during installation of Fox River Valley officers at Hotel Baker, St. Charles, Ill., March 22. The group, left to right: T. L. Kings, Secretary; Mr. Martindell, Mr. Braun, and G. M. Waller, First Vice-Chairman.

Cutting Fluids Control Build-up of Tool Edges

Aurora, Ill.—March meeting of Fox River Valley Chapter was held at Hotel Baker, St. Charles, Ill., on the 22nd. Chairman Thomas L. Kings introduced Director Frank Martindell who officiated at the installation of officers.

Those taking the oath of office were: Chairman, H. J. Braun, Kennametal, Inc.; First Vice-Chairman, G. M. Waller, Burgess-Norton Mfg. Co.; Second Vice-Chairman, Roy G. Frogness, Fox Valley Engineering Co.; Secretary, T. L. Kings, Austin-Western Co.; Treasurer, B. J. Phillips, Phillips Auto Parts Co.

The technical session was presented by engineers of Socony-Vacuum Oil Co. C. H. Johnson, Industrial Service Engineer, outlined operating conditions affecting the choice of proper cutting oils.

B. F. Wilson, Cutting Fluids Technician, followed with a brief history of the development of water solubles and cutting oils. This talk was augmented by a series of slides which showed the effect of cutting oils in control of build-up edge on high speed steel cutting tools.

Carney Stirs Executives To Economic Perils

St. Louis, Mo.—An enthusiastic group of 329 members and guests attended St. Louis Chapter's Annual Executives Night and installation of officers, March 7, at the DeSoto Hotel.

Guest speaker was Ralph W. Carney, Vice-President in Charge of Sales, The Coleman Co., Inc., Wichita, Kansas.

Mr. Carney, a forthright speaker and astute business man, captured the audience and held its attention for an hour and a half with his outstanding address, "A Business Man Speaks Up." His hard-hitting and powerful message covering the economical and political ills confronting us today has been acclaimed by audiences throughout the country.

E. A. Doogan, original Chapter Chairman, swore in the new Chapter officers: J. J. Demuth, Chairman; E. H. Ruder, First Vice-Chairman; H. M. Creasey, Second Vice-Chairman; O. W. Johanning, Treasurer, and Rudolph Kick, Secretary.

Will Work on Twist Drill Standardization Program

Detroit, Mich.—William Moreland, Assistant Master Mechanic at the Chrysler Corporation's Jefferson Avenue Plant, has recently been appointed to work on the Sectional Committee for Twist Drill Standardization being sponsored by General Motors Corporation and the American Standards Association.

William Moreland

His appointment to this Committee was made by W. H. Smila, Chairman of the ASTE National Standards Committee.

A member of Detroit Chapter, ASTE, Mr. Moreland is very active in standardization work, serving on the Society's National Standards Committee and Data Sheet Sub-Committee.

More than 300 members and industrial executives turned out for the Annual Executives Night and installation of St. Louis Chapter officers at March 7 dinner meeting in the DeSoto Hotel. Principal speaker was Ralph W. Carney of The Coleman Co., Wichita. Officers were inducted by the Chapter's first Chairman, E. A. Doogan. At speaker's table (rear, left to right) are: T. C. Stephens, Past Treasurer; Mr. Doogan, retiring officers—W. H. Scheer, First Vice-Chairman; Robert W. Boehlow, Secretary; Ralph H. Roth, Second Vice-Chairman; and W. G. Eberhardt, Chairman; Mr. Carney, Clarence L. Miller, Past Chairman; J. J. Demuth, Chairman; Edward H. Ruder, First Vice-Chairman; H. M. Creasey, Second Vice-Chairman; O. W. Johanning, Treasurer; and Rudolph Kick, Secretary. (Last man unidentified). Mr. Carney, a forceful speaker, used as his subject, "A Business Man Speaks Up."

Retiring Chairman Eric Crawford administers the oath of office to Toronto Chapter's new executives at March 11 meeting in Malloney's Art Gallery. Left to right: Mr. Crawford, J. B. Burk, Secretary; George Elliott, Second Vice-Chairman; Harold C. Upton, Treasurer; Walter W. Appleton, Chairman; and L. M. Jardine, First Vice-Chairman.

Choice of Threading Method Important Cost Factor

Toronto, Ont.—More efficient operation of die-heads, thread cutting machines and collapsible taps to obtain good quality threads, was the theme of Charles Reimschissel, speaking March 11 at Malloney's Art Gallery before an audience of 220 members and friends of Toronto Chapter.

Charles Reimschissel

Mr. Reimschissel, Director of Die Heads and Patents for Landis Machine Co., Waynesboro, Pa., with at least 25 patents to his credit and a number pending, spoke from experience and with authority.

Four Threading Methods

Explaining the four methods of producing threads: cutting, milling, grinding and rolling, he stressed the accuracy now obtainable by the latter method.

However, he made it clear that the other three methods have their advantages, and that the choice of method to produce a given quantity of threads demands serious consideration, before production begins. Much time, expense and useless waste may be the outcome of hasty haphazard guesswork, he emphasized.

The speaker then discussed Rockwell hardness as applied to chasers. He gave data on cutter angles and clearances to produce high finish and clean-cut threads. The old problem, the square cut shoulder, he dealt with in detail. Timely hints on a variety of chaser problems proved of great interest.

Shows New Model

Following the main speaker, G. M. Stickell, Vice-President and Sales Manager of the Landis Machine Co., demonstrated a wooden model of the company's most recent thread rolling machine.

In this machine a stud is threaded at both ends simultaneously, using circular dies. The machine is hopper fed, and the dies have clearance ground on their periphery so that they bear only on the unrelieved section as the machine revolves.

This model and the methods involved created considerable comment. Mr. Stickell predicted that, while the machine was still in the experimental stage, it had a bright future.

A lively discussion followed, interest being divided between thread cutting and thread rolling methods.

Eric Crawford, retiring Chairman, conducted the installation of newly-elected Chapter executives in an impressive ceremony. The following officers were sworn in for 1946-47:

Walter W. Appleton, Chairman; L. M. Jardine, First Vice-Chairman; George Elliott, Second Vice-Chairman; Harold C. Upton, Treasurer; and J. B. Burk, Secretary.

Mr. Crawford thanked the members for the support he had received during his term in office. He then presented Mr. Appleton with the Chairman's pin, and the latter took over the chair.

Speaking briefly on the past year and the year ahead, Chairman Appleton promised to serve faithfully and to the best of his ability.

Humorist Demonstrates "Postwar Products"

Rockford, Ill.—A meeting for members only was held March 7 by Rockford Chapter, in the Rainbow Room of the Faust Hotel.

The evening's program opened with installation of Chapter officers for the ensuing year by Director Frank Martindell of Chicago Chapter.

Donald Hawkinson, the new Chapter Chairman, introduced the speaker, Russell E. Oakes of Waukesha, Wis. Mr. Oakes gave a humorous talk on "Postwar Products with a Punch," which he illustrated with working models. All of his inventions and models were of the Rube Goldberg type.

Following this laugh session, smorgasbord was served to the 175 members present.

* * *

On March 16, the Chapter held their Annual "All Engineers" dance in the main ballroom of the Faust Hotel.

Seventy-five couples attended the "Cabaret Style" dance. Bill Engberg's fifteen-piece band furnished music for the dancers.

Transportation Engineer Tells of German Collapse

Erie, Pa.—At the March meeting of Erie Chapter, installation of officers was followed by an engrossing talk on "The Last Days of the German War Machine," by H. W. Gouldthorpe, Transportation Engineer of the Erie Works, General Electric Co.

Officers inducted were: Harold W. Hagle, Chairman; John C. Wilcox, First Vice-Chairman; Ray Karlen, Secretary; and John F. Fogleboch, Treasurer.

Mr. Gouldthorpe's remarks were illustrated by excellent color slides that he made as a member of the Allied Industrial Commission. In one of the most interesting addresses of the year, the audience was carried through bomb-damaged Paris, on to London and into Germany and Austria.

The disintegration of the German army transportation system, from a highly mobile force using every modern conveyance to an organization largely dependent upon the horse and ox, was graphically illustrated.

The meeting ended with a buffet luncheon.

Magnesium Machining Processes Screened

Philadelphia, Pa.—"The Working of Magnesium," a film production sponsored by Dow Chemical Co., was presented to Philadelphia Chapter members at a recent meeting in the Engineers Club.

The motion pictures stressed proper coolants for machining magnesium. Fire hazards were demonstrated by burning chips—dry, water-soaked and oil-soaked. The water-soaked chips burned most briskly.

Closely-woven clothing was recommended for workers, and cleanliness strongly advocated. After completion of machining operations, the sequences revealed, magnesium parts must have a protective coating.

Tools Must Be Sharp

Sharp tools are necessary for cutting magnesium, the film demonstrated, but high speeds can be attained without sacrificing tool life.

Another educational film, presented by The Cleveland Twist Drill Co., pointed out "The Uses and Abuses of Twist Drills."

Election of officers gave the administration of Chapter affairs for 1946-47 to: Howard W. Gross, Chairman; Arthur R. Diamond, First Vice-Chairman; Samuel R. Boyer, Second Vice-Chairman; W. Warren Cady, Secretary; and H. F. Holden, Treasurer. Thomas Donovan was named Delegate, with John McMonagle as Alternate.

Approximately 125 members participated in the election.

Howard Gross (left) acknowledges applause of Philadelphia Chapter on his election as Chapter Chairman. Group at right eagerly awaits tellers' report on outcome of election at recent meeting.

R. E. Ginn (left) of the James H. Mathews Co., gives Pittsburgh Chapter members information on procedures for marking materials. Mr. Ginn was technical speaker at March 1 meeting in Fort Pitt Hotel. Right: Newly-installed officers are (left to right): G. C. Wood, Treasurer; Karl G. Johnson, Secretary; William H. Schott, Chairman; P. H. Magnus, First Vice-Chairman, and W. H. Risser, Second Vice-Chairman. Eighty Chapter members were present for the installation.

Ginn Evaluates Methods Of Marking Materials

Pittsburgh, Pa.—March meeting of Pittsburgh Chapter was held on the 1st at the Fort Pitt Hotel. Eighty members attended the dinner meeting.

C. E. J. Brickner, retiring Chairman, installed the newly-elected officers: William H. Schott, Chairman; P. H. Magnus, First Vice-Chairman; W. S. Risser, Second Vice-Chairman; Karl G. Johnson, Secretary; and G. C. Wood, Treasurer.

Guest speaker of the evening was R. E. Ginn, Vice-President of the James H. Mathews Co., who spoke on "The Value of Marking." The speaker explained material marking and the various methods employed.

Norton Names Cannon Merchandising Engineer

Worcester, Mass.—Robert H. Cannon has recently been appointed Merchandising Engineer for the Norton Company. He will be located at the home office in Worcester.

R. H. Cannon

Mr. Cannon has been associated continuously with Norton Company since 1916, except for a year and a half spent in the Army Air Service during World War I.

Before his recent appointment, he served in the Cleveland and Ohio territories. Following graduation from Clark University, Worcester, he was employed by Dennison Mfg. Co.

Mr. Cannon has been an active member of Toledo Chapter since 1938.

Engineering Head Retires From Oldest Company

Detroit, Mich. — Marcel A. Atlas, a partner in Mechanical Engineering Service, Detroit, was honored with a farewell dinner at the Wardell-Sheraton Hotel, recently, by 45 representatives of local engineering companies.

The occasion marked his retirement from the oldest engineering concern in the city, conducted by Mr. Atlas and his partner, George E. Leggatt. Both are charter members of ASTE.

During the evening his confreres presented Mr. Atlas with a gift as a token of esteem.

Operation of the business will be continued by Mr. Leggatt and his new partner, Robert C. Fairchild.

Situations Wanted

GEAR PROCESS ENGINEER—Navy veteran, age 28, graduate, Industrial Engineering, General Motors Institute, seeks position. Broad experience as Process and Tool Engineer in aircraft engine mass production and as Methods Engineer in instrument manufacture. Write Box Y, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Michigan.

GRADUATE INDUSTRIAL ENGINEER, 28, married and a recent veteran, desires to locate in New England. Four years' experience with incentives, job analysis, methods, and some jig and fixture design. Excellent references. Write Box Z, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Michigan.

INDUSTRIAL ENGINEER—Army veteran, specialized in Tool and Machine Design, Processing and Plant Layout, desires employment in this field, preferably in Detroit area. Education: 2½ years college, 1 year correspondence courses (Mech. Eng'g), graduate of Technical High School.

Experience; ½ year Tool and Die, ½ year Production, ½ year Welding, 1 year Time Study, Production Control, Plant Layout; 3 years Tool and Machine Layout, Design, Follow Up; 1½ years U. S. Army Ordnance Branch, Base Shop; 1 year Processing and Product Design. Formerly Chief Engineer, Job Shop. Write Box B, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Michigan.

TOOL ENGINEER—Army veteran, 29, educated University of Michigan and General Motors Institute, wishes connection offering future security rather than large remuneration. Before entering service was Asst. to Chief Engineer (auxiliary aircraft engines) and Production Engineer. Willing to settle anywhere in U. S. Write Box A, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Michigan.

Heckinger Returns From South Seas

Philadelphia, Pa.—David J. Heckinger, in the St. Louis office of the Vascoloy-Ramet Corporation prior to entering the Service, has been transferred to that company's Philadelphia office, according to an announcement made by Eugene Roth, Eastern District Sales Manager.

D. J. Heckinger

Mr. Heckinger spent 28 months in the South Pacific with the Fifth Air Force Service Command. He returned to Philadelphia April 1 to resume his ten-year association with his company.

An active member of St. Louis Chapter, ASTE, Mr. Heckinger was Chairman of the Chapter Public Relations Committee for 1942 and 1943. He served on the Publicity Committee handling the 1942 Annual Meeting in St. Louis and assisted in the establishing of Kansas City and Decatur Chapters.

Notice
Chapter Chairmen

The Tool Engineer should be on your mailing list for Chapter meeting notices.

Please send notices to: ASTE News Editor, *The Tool Engineer*, 550 W. Lafayette, Detroit 26, Mich.

Officers Installed Committees Named

New Orleans, La. — Inauguration of 1946 officers highlighted the March 18 meeting of New Orleans Chapter held in the Airplaners Club.

Sworn into office by Chapter Chairman Edwin E. Graf were: J. Owen Evans, First Vice-Chairman; Edgar A. Faber, Second Vice-Chairman; Walter T. Darvin, Secretary; and Manuel Nova, Treasurer.

On completion of the installation ceremonies, Mr. Graf announced the appointment of the following Committee Chairmen: Marcel J. Bayhi, Constitution and By-Laws; James D. McClendon, Standards; William R. Becnel, Education; Gilbert Durand, Public Relations; Edgar A. Faber, Membership; and Joseph A. Evans, Editorial.

The meeting closed with the serving of refreshments.

New Orleans Chapter installed its 1946 officers at March 13 meeting in the Airplaners Club. Left to right: Walter T. Darvin, Secretary; J. Owen Evans, First Vice-Chairman; Edwin E. Graf, Chairman; Edgar A. Faber, Second Vice-Chairman; and Manuel Nova, Treasurer.

Swearing to uphold the Constitution of the Society are Toledo Chapter's new officers (left to right): Chairman R. M. Hindman, First Vice-Chairman Albert Hage, Second Vice-Chairman V. G. Kessler, Secretary L. F. Rothert, and Treasurer R. H. Brown. National Secretary A. M. Schmit (facing officers) conducts installation at March 13 meeting in the Commodore Perry Hotel. Members seated at rear witness ceremony.

Civic Program Featured At Installation Dinner

Toledo, Ohio—Distinguished business and industrial executives were guests of Toledo Chapter at their Installation Banquet, March 13, in the Commodore Perry Hotel.

Col. D. L. Sears, of the 37th Division and a prominent Toledo attorney, served as Toastmaster.

Speakers of the evening were Stanley Grove, Executive Manager of the Toledo Chamber of Commerce, and Burdette M. Baldwin, both of whom were well informed to discuss conditions in the "Toledo of Today" and the possibilities for "Toledo of Tomorrow."

National Secretary A. M. Schmit administered the oath of office to Chairman R. M. Hindman, Doehler Jarvis Co.; First Vice-Chairman Albert Hage, Hage Industrial System; Second Vice-Chairman V. G. Kessler, Spicer Mfg. Corp.; Secretary Lawrence F. Rothert, Kent-Owens Machine Co.; and Treasurer Russel H. Brown, American Floor Surfacing Machine Co.

Retiring Chairman Samuel W. Burgess received a Past Chairman pin as the gift of the Chapter.

Rives Advances To Chairmanship

Phoenix, Ariz.—Members of Phoenix Chapter met recently at the Duppa Villa Recreation Hall to elect new Chapter officers.

First Vice-Chairman Harry E. Rives, who has acted in the capacity of Chairman since the resignation of Charles Clark, was elected to the latter office. Mr. Rives is owner of the Rives Construction Co.

Others named to serve for the coming year were: First Vice-Chairman, Beryle W. Williams, Shop Coordinator, Phoenix Technical School; Second Vice-Chairman, Patrick E. Curley, Manager, Thompson & Curley; Secretary, Rae K. Edgar, Manager, Housing Authority of the City of Phoenix; and Treasurer, Carl J. Weingartner, Tool Engineer, Goettl Metal Products.

Mr. Weingartner was named Delegate to the national convention at Cleveland.

Technical feature of the evening was a demonstration of the Micro-Arm, a device used in layout work, by Frank J. Pezak, a Chapter member.

Refreshments followed the meeting adjournment.

Humanics Must Advance With Mechanics, Lee Says

Peoria, Ill.—"The field of human relationships must be approached in as selfless, childlike and open a manner as the field of science," Dr. Ralph L. Lee of the Employe Co-operation Staff, General Motors Corp., Detroit, told several hundred members of Peoria Chapter, ASTE, the Peoria Engineering Council and their guests at a meeting in Pere Marquette Hotel, March 5.

Dr. R. L. Lee

"Humanics must go hand in hand with mechanics," Dr. Lee said, in advising the engineers on four "vital and important" points in understanding employe relations.

1. Everyone is different and the only one of his kind in all the world.

2. Most people are as they are because they can't change as much as they want to or as much as others would like them to.

3. No one is the same at all times.

4. Everyone takes pride in being "different."

Dr. Lee described typical employees found in every business—the bully, the pouter, the finagler, the ants-in-the-pantser, the runner-off-the mouth, the creative genius, the Sphinx, the prevaricator, and lastly, the one who progresses legitimately, meeting everyone more than halfway.

People, he compared to materials: steel, copper or aluminum—lightweight, but giving good performance; glass—transparent and easy to see through; and clay—wet, but durable and useful when molded by a skilled hand.

Dr. Lee is nationally recognized in the field of industrial personnel relations.

Cogburn Installed As Chairman

Atlanta, Ga.—Highlight of the March meeting of Atlanta Chapter was the installation of new officers for the 1946-47 season. As is customary, the retiring officers presided at this meeting.

The new Chapter executives who took the oath of office were: J. C. Cogburn, Jr., Chairman; C. M. Jenkins, First Vice-Chairman; J. S. Roberts, Second Vice-Chairman; George W. Brown, Secretary; and C. F. Bolden, Jr., Treasurer.

Following the dinner and business meeting, a highly interesting and educational program, "Grinding Practice and Abrasives," was presented by the Carborundum Company.

R. F. Courter and E. W. Bryson showed sound motion pictures depicting the discovery and development of man-made abrasives. They also conducted an informal discussion of grinding problems as presented by various members.

Georgia Tech New Meeting Place

Through the good offices of Major A. A. Case, Head of the Mechanical Engineering Department of Georgia School of Technology and a new ASTE member, the Banquet Hall of the School, where 1946 meetings have been held, will be the permanent Chapter meeting place.

Georgia Tech is one of the few schools in the country recognizing the rightful place of tool engineering as a profession by including a course in Tool Engineering in their curriculum. Atlanta Chapter is watching this move with interest and will collaborate in every possible way to further the development.

At the previous meeting The Warner & Swasey Company presented an interesting program on "Chips," showing motion pictures of proper methods of tool grinding and setting for the best results in turning practice.

Installation of Atlanta Chapter's 1946-47 officers was conducted at the March meeting in the Banquet Hall of Georgia School of Technology. Left to right are: George W. Brown, Secretary; C. M. Jenkins, First Vice-Chairman; J. C. Cogburn, Jr., Chairman; C. F. Bolden, Jr., Treasurer; and J. S. Roberts, Second Vice-Chairman.

Caught in these candid shots snapped by National Director W. W. Young at recent Boston Chapter meeting are, left to right: P. A. Miller, Constitution and By-Laws Chairman, and Chief Engineer, American National Corp., Randolph; J. B. Savits, newly-elected Chapter Chairman, and Chief Methods Engineer, Pneumatic Scale Corp., Ltd., North Quincy; T. W. Whittle, Ass't Shop Supt., U. S. Naval Shipyard; Harold D. Stuck, Membership Chairman, and Supt., John W. Bolton & Sons, Inc., Lawrence; and Ralph I. Robbins, Administrative Engineer, Submarine Signal Co.

Milling Film Premiered

Boston, Mass.—Annual meeting of Boston Chapter to elect new officers was held recently at Schrafft's Restaurant.

Results of the voting were announced by Tellers Robert Morris and John Lindegren, as follows: Chairman, Jack Savits; First Vice-Chairman, Jack Ryneska; Second Vice-Chairman, W. W. Young; Secretary, W. Swanson; and Treasurer, A. J. Leone.

National Director W. W. Young was elected Delegate, and Warren Ames, Alternate. Robert McLean and Henry J. Richards were named Engineering Society of New England Directors.

Gadget speaker was Joseph Crosby, Sales Manager of Lapointe Machine Tool Co., Hudson, Mass.

Mr. Crosby demonstrated and explained the use of a device, built on the principle of a sine bar, which trues grinding wheels to an accuracy of a few seconds.

He also exhibited a magnetic Vee-block with a small worm gear, the worm operated by a clock key and adjustable to 180 degrees. Both devices are used extensively in grinding broaches.

W. Hart Nichols of W. H. Nichols & Sons, Waltham, Mass., spoke on "The Hand Miller from the Tool Engineer's Standpoint." Mr. Nichols explained the design of the counter-balanced rise-and-fall spindle head, hand milling machine, tracing its history back to the original design invented by Woodruff. This machine was planned to overcome difficulties encountered by milling machines of that period in cutting keyways for the new half-round Woodruff keys.

The present "Nichols" miller, the result of long planning, hard work and common sense, is based on the proposition that the way to high wages is by producing better products at lower cost.

The spindle is equipped with non-friction bearings, and the diversification of the machine is such that contour milling may be performed by the rise-and-fall head.

Mr. Nichols described in detail the ease with which the head is controlled by a lever and the simplicity of the table movement actuated by a rack and pinion or a feed screw, or both.

His talk was supplemented with the premiere showing of the new Nichols film, "The Miller That Uses Its Head."

Forecasts New Plastics Applications, Products

Washington, D. C.—W. Ward Jackson, Director, Product Application Dept., Celanese Plastics Corp., was the technical speaker at Potomac Chapter's March 7 meeting in Hotel 2400.

Mr. Jackson's subject was "Cellulosics: Nature's Strongest Building Blocks."

The speaker, who heads a planning group evaluating new materials and products in various plastics, explained the general structure of cellulosics, their applications, and characteristics of plastic products.

A film, "Careers for Cellulose," augmented the program.

Newly-elected officers installed at the meeting were: Robert T. Plitt, Chairman; R. P. Thayer, First Vice-Chairman; H. M. Frazier, Second Vice-Chairman; Daniel T. Hilleary, Secretary; and Earl K. Trone, Treasurer.

Lawrence Didszoneit, retiring Chairman, received the Chapter's gift of a Past Chairman's pin, Director E. M. Seifert making the presentation.

* * *

At the previous meeting Louis Lingler of the Educational Services Dept., and Jack Welch of the Machine Tool Sales Dept., Sheffield Corp., Dayton, Ohio, collaborated in presenting a program on "Crush Dressing Methods."

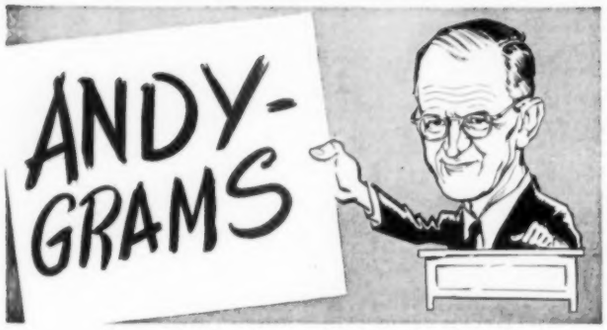
Slides, charts and samples supplemented their description of crush dressing and its many applications.

Leaves Firth-Sterling

Chicago, Ill.—Edwin T. Jackman, who has been District Sales Manager of the Firth-Sterling Steel Company in Chicago for the past eighteen years, has resigned his position with that company.

Mr. Jackman is a member of Chicago Chapter, ASTE.

Right: Gifted with a Past Chairman pin, by Potomac Chapter, Lawrence Didszoneit, retiring Chairman, is extremely happy. Director E. M. Seifert makes presentation. Far right: A member inspects display of samples exhibited by Louis Lingler (right) and Jack Welch (center) of the Sheffield Corp., following their discussion of "Crush Dressing Methods." Below: A group of officers (left to right): E. K. Trone, Treasurer; H. M. Frazier, Second Vice-Chairman; R. T. Plitt, Chairman; E. M. Seifert, National Director and Delegate; Lawrence Didszoneit, retiring Chairman; J. C. Reed, Alternate; D. T. Hilleary, Secretary; and R. P. Thayer, First Vice-Chairman.



As usual, you ladies North, East, West, South may be looking to the Column to see if your boy friends behaved 'emselves during the Convention. I'll say they did! What with walking, talking, working, selling, buying and attending sessions, they'd just no steam left for whoopee. As for that, these ASTE Conventions are serious business, lightened mainly by the pleasure of meeting old friends and making new ones, and by the good fellowship for which this Society is noted.

Crossed over to Cleveland via boat where, lulled by a *skoal* with Bob Powers and Jay Hammen—their treat, of course—I enjoyed a good sleep and woke up my usual blithesome self. The worry of getting a room, then to the Directors meeting, to sit on the sidelines while the boys decided the fate of the Society. They did right well! So, for that matter, did the House of Delegates, giving us ten good men and true to head the Society for the coming year. And Ray Morris, as Ch'man of the Nominating Com'tee, presented us with excellent officers for '46, men of outstanding ability and each trained in the work of the Society. We go on to even bigger things!

The various Committees came in for some nice comments, as did THE TOOL ENGINEER. And for once, I wasn't put on the pan although, via grapevine, I learned that some of the boys were gunning for me a/c my plugs, in the February issue, for several of the nominees. All friendly, y'understand—they smiled when they called me "that"—and no quarrel with my judgment. 'Twas just the "principle of the thing."

In this connection, I want to make it clear that the thoughts expressed here are entirely my own and in nowise suggested by any individual, or by any faction, of which none exists in this Society. And, except that I would not intentionally write anything that would embarrass a member, or reflect on the Society, they are uncensored. So far, no individual, or group of individuals, has had any intimation of mention until the Magazine has come to hand. And so far, no individual has been hurt by a friendly mention that, in the main, has been well deserved. I'm telling you this so that, in the future, innocent parties won't be blamed for my brainstorms.

Sunday evening, to the Preview in the Auditorium. The first thing that caught my eye, as I came in by the exhibitors entrance, was the slogan—MEN WHO MAKE DREAMS COME TRUE—blazoned across the big curtain in the Arena. Pratt & Whitney's Ed Shultz, who conceived it, can well be proud of his contribution.

As for the Show, it was breath taking!—an all time high in the history of a Society—the ASTE—that, in itself, has made industrial history. Yet, in the comparative emptiness, on the eve of the Exposition, I was conscious of misgivings: "Will we ever get enough people, into this vast place, to warrant the huge cost (estimated at close to $2,500,000) of setting up the Show?"

But they came!—from North, East, West, South in the United States; from the far reaches of Canada, from England and Sweden—swelling the attendance to nearly 58,000! And these were *key men in industry*, come by invitation and each critically viewing a galaxy of tools of which each, from accessories to intricate production machines, was designed to cut costs in the face of rising wages. Oh yes, the Show paid!—made "dreams come true" for exhibitors and spectators alike.

Naturally, some exhibits attracted more attention than others, and this held especially for "action shots"—i.e., machines in action—as compared to "stills." The gage exhibits, from Ames to Vinco in alphabetical order, were jammed throughout the Show, as were the optical comparators and inspection devices. The same held for the several exhibits of induction heating—but then, one was hard put to get near any of 'em. F'rinstance, it took me three days to get near enough to Superdyaulic's Ted Nagle to even say "hello."

Looking up *auld acquaintance* in the riveting game, I passed the time o' day with Hanna Engineering's Art Jensen and L. C. Hanna, Hannifin's Ralph Bean and Otto Maha, and dropped in on Otto Mueller to admire his hydraulic stripper. It's really good! Look-seed Chicago Pneumatic's exhibit from the fringe, then, 'round and 'round the Show, stopping for a li'l reminder to Vicker's Rudolf Esch until, my dogs howling, I sank to rest in one of Larry Rademacher's Stokerunit chairs. Larry, like Grant Wilcox, has taken to the air, only, he had to get himself a transport job to sustain his heft.

Going past Snyder Engineering's booth, where George Whitehouse presided, I thought I saw fire, but it turned out to be Rip Collins, all sunburned from playing golf under a Texas sun in his shorts. With Rip and Ralph Hammond, also a Houstonite, went out to the Ajax Mfg. Co., George Martlock, Ajax sales engineer, conducting. At the plant, saw powerful forging presses in the making and also had occasion to admire the ingenuity of press forging engineers, as evidenced by a display in the Ajax *museum*.

Tuesday, absented myself to attend the Westinghouse Machine Tool Electrification Forum, in Pittsburgh, where a score or more editors constituted a small minority, among the engineers, come to hear leaders in the electrical field expound the theories and practices of electric motor drives. Of that, more later in the editorial pages of THE TOOL ENGINEER.

While there, had the pleasure of meeting Carl Nagel, recently appointed manager of the Westinghouse Technical Press Service, and his associates Val Laughner and H. C. McDaniel. They're swell boys, and being engineering graduates with plenty on the ball, I can foresee their rise in the Westinghouse organization.

While digressing, I might mention the recent Editors' meeting at Haynes Stellite Company. We all know, of course, what Stellite did in revolutionizing the cutting of metals, back in '15, and the boys in Kokomo have been going ahead ever since. What struck me, particularly, was the "good housekeeping" evident throughout the plant (aside from a preponderance of beautiful women) and the "lost wax" process for precision casting of hard metals, brought to a high art at Stellite.

At the Show, had the pleasure of meeting Haynes Stellite's friendly Jim Todd, and Len Church, of Hill & Knowlton, of whom I had pleasant memories from my visit to the Monarch

Machine Tool plant. And, looming in the crowd, Ed Beyma's bulk and Al Nancarrow, the latter with an advantage of altitude. Luke Beach, whom I hadn't seen in years, and Tom Bradford from Worcester. Bill Sherman, propagating Automotive's Golden Jubilee; Walter Pohle, Boston's ace gadgeteer; Al Mitchel and Steve Urban of Syracuse. Crashed in on Al Sargent's sanctuary to be regaled with Jim Scott's inimitable stories. (His *alligators* are still slithering around my neck.) Dinner with Ed Halvorsen of Cro-Micron Process & Research Corp'n, winding up by taking his c'k and application for membership. All roads led to the Show!

Right here, an interruption in the writing. (I'm back at the office, y'see, trying to unscramble my notes.) The phone rang, and who should it be but John Nelson—you know, Johnny with the inimitable laugh—calling to tell me how well he likes the new TOOL ENGINEER. He is now with Putnam Tool. I hung up to find a new friend (Sven Larsson of Albin Motors, whom I'd met at the Show—he'd come all the way from Sweden to see it) standing at the desk.

So, I took him over to the Society H.Q., in the Penobscot Bld'g, to have him and his dad—the latter in Sweden—written up as members. Oh, they're qualified tool engineers! When I got back, Swan Bjornberg of Illinois Tool W'ks was waiting for me, along with local representative John McDonald. At lunch, it turned out that Swan and John Nelson are old pals, and so here they meet!—in the Column. Yep, this ASTE is just making the world smaller and smaller for us tool engineers.

With that, back to the Show. Bumped (literally) into Jay Bowen and Ken Spaulding at the Universal Duplicator Exhibit, then crossed the aisle to see Paul Zerkle, Harry Gotberg, Marvin Anderson, Arvid Lundell, S. B. Hellstrom and A. D. F. Moncrieff of the composite Michigan Tool—Colonial Broach-Detroit Tap & Tool family. At the ASTE *lounge* where, like 42nd St. and B'way, you'd see everybody if you waited long enough, I met Brown & Sharpe's B. P. Graves—among many others—only I didn't tumble until he took his hat off. As for me, even strangers picked me out as Mr. Andygrams a/c my lineated phiz, above.

All during the week, the Canadians trickled in; Eric Crawford, of *Canadian Machinery*, Len Singer, Harry Whitehall and John Walton, and Bill Dawson, who refused the Nat'l Sec'yship but who got put to work regardless; Stentor Bill McLaren, of Dominion Eng'g W'ks Ltd., and his buddies from Montreal—Otto Wright, Don McKenzie, Jerry Rogers, Jack Rodel, Frank Spence and Harry Welch. A bus load, too late for the banquet, came in from Hamilton on Friday. As Bob Douglas said to Hallet Jones, these Shows are fine for "promoting good feeling internationally."

If I only had space to mention everybody! But then, you'll find the best story of the Show in the ASTE News. Hart Beardsley, enterprising Springfield (Vt.) membership ch'man whose Chapter took the Cup; Ed Berry of Little Rhody, who suggested new material for THE TOOL ENGINEER; likeable George Brown, Atlanta Sec'y; George Keller, who I'd know by his handshake were I blind. Bill Flashenberg, to take me around to Axel Anderson's Rockford Powergrip Chucks. Wotta grip! And genial Ed Dickett, who missed being President by a vote, some years ago, but who took defeat gracefully and who has continued to work untiringly in the Society's behalf. Good boy, Ed!

Thursday night, the banquet! From the balcony, where I sat with THE TOOL ENGINEER and H.Q. staffs, the Society *elect* looked right smart in their soup and fish although, I rather suspect, a few of the boys had to be a mite careful when sitting down. A *skoal*, across the room, with Harry Conrad, Bill Dawson and Jim Frederick. From the gallery, spotted King Cole—and shied a cigarette that landed in his neighbor's coffee. Next time I'll bring a beanshooter.

Below me, Walter Wagner, Bert Carpenter and Bill Smila. I've yet to take Bill's shirt, by token of which there's still an incentive in life. When registering, the girl taking Bert's *dossier* asked his name and company position, whereat Bert facetiously gave his title as sweeper. And that's what she typed on his badge! Oh yes—I almost forgot!—we ate as well as looked and listened. At that, I suspect it was Doris Pratt's first square meal during the Show, that indefatigable lady having worked, night after night into the small hours, getting out the Exposition dailies.

Reports, address by officers and guest speakers; installation of the new officers. Clete Briner, who wound up his term in fame and glory, passing the gavel and his *war bonnet* to Al Sargent. One good man succeeds another. Packard's Prex, George T. Christopher, who called us the "middle men of technology." (That's what I've always said—we're in the middle.) He also said that one of our outstanding characteristics is our inconsistency. "If he (the tool engineer) has too much respect for his first idea, he will never accomplish the possible." To that might be added that the tool engineer is unpredictable, by virtue of which he accomplishes the heretofore impossible.

E. W. Hancock, W'ks-Gen'l Mg'r of Rubery-Owen & Co., England, and holder of a raft of titles (I looked for the Garter) came to present an honorary membership in the Institution of Production Engineers—British equivalent to the ASTE—to our Prex and to further the good fellowship between our respective groups. He also presented a coat-of-arms which, regretfully, can't be reciprocated. That reminds me. The ASTE promised me a bronze placque or something (why, I don't know) some years ago. I've come to suspect that the boys are saving it for a grave marker.

Ot Winter, the lucky stiff, surrounded by a galaxy of beauty. So was I (at first) but they gravitated to Charley Hasse like filings to a magnet. Some day, I'll entice the *silent partner* along—say when we trek to Houston, next year. John Lapham, and his glamorous fellow (how would you put it in feminine gender?) tool engineer, Miss Amis, from Ft. Worth. Oh, I tell you, there was brilliance and *eclat* at the banquet.

Through Fred Hebert, of hydraulic renown, I met Richard B. Smith, exec. sec'y of the A.S.M.E. manufacturing eng'g com'tee, whom I hope to meet again when we have more time for talk. We were joined by Carl Lanstrom, of Pittsburgh, who wanted to see if I really resembled the cartoon. As the diners swarmed out, met Clif Ives, grown a trifle graver but as warmly friendly as ever, Red Cole, from Houston, and Jim Linsley, of *Iron Age*, who'd got himself a new (old) gun. Ray Farmer, who reported "a good business," and Mrs. F., also, Clyde Mooney and his winsome better half. Yep, 'twas a grand evening.

Friday, the wind-up, but with unflagging interest until curtains. Back to Detroit by boat when, after a nightcap with Bill Klemm of *Comparoscope* and Jim Buchanan, headed for bed and the prospects of sleep. But, some of the boys were relaxing after the grind, as a result of which Sweet Adeline kept me awake until the wee wee hours. At that, I was up betimes and, "east, west, hame's best"—even if it does mean burnishing the nose against the ol' grindstone. With that, *Au Revoir*.

Andy

North East West South in Industry

VANADIUM-ALLOY STEEL COMPANY, Latrobe, Pa., has assigned **J. Cleveland McKenna** as Advertising Manager to replace Lawrence Wood, resigned. Mr. McKenna is a graduate of Dartmouth and of Harvard Graduate School of Business Administration, and before his appointment as Advertising Manager, was associated with V-A in the capacity of a Director and metallurgist.

To obtain more comprehensive industrial engineering coverage, three new divisions have been added to **GENERAL ELECTRIC'S** *Industrial Engineering Divisions*. As announced by **J. D. Wright**, Division Manager, these are: Power Electronics, Materials Handling & Testing Equipment, and Rubber & Printing. In addition, the Machinery Div. has been reorganized.

The first, headed by **L. W. Morton**, is concerned with the application of electronics to problems of power conversion in industry. The second, with **M. A. deFerranti** in charge, deals with elevators, cranes, and hoists, as well as electrical equipment used in wind tunnels and for testing jet and conventional aircraft engines. The third, under the direction of **G. W. Knapp**, will handle rubber processing and all branches of the printing industry, in addition to applications of electrical apparatus to the food industries.

The reorganized Machinery Div., headed by **H. W. Poole**, will apply new and improved drives to machine tool and automotive machinery, as well as cover the automotive, farm machinery, and other metal-working industries.

Appointment of **Harry A. Dennis** as Sales Representative in Erie, Pa., and vicinity, for **LUKENS STEEL CO.**, and subsidiaries, Coatesville, Pa., has been announced by J. F. Wiese, Vice-Pres. in charge of sales. Mr. Dennis, a graduate of Pennsylvania State College, has been engaged for the past several years in welding engineering for the company.

The 1946 officers of the **RESISTANCE WELDER MANUFACTURERS' ASSOCIATION** are **H. B. Warren**, Lynn, Mass., President; **G. N. Sieger**, Detroit, Vice-President; **George A. Fernley**, Philadelphia, Executive Secretary, and **H. R. Rinehart**, Philadelphia, Secretary-Treasurer.

New officers of the Electric Industrial Truck Association include **Gordon J. Berry** (left), and **F. J. Shepard, Jr.**, respectively elected president and vice-president. Mr. Berry is vice-president of the Electric Products Co., Cleveland, and Mr. Shepard is treasurer of the Lewis-Shepard Sales Co., Boston.

The Association comprises major producers of electric trucks, batteries and chargers used by industry for materials handling.

Joseph L. Dostal announces the formation of the **DOSTAL PER-MOLD FOUNDRY CO.**, Pontiac, Mich., and the simultaneous purchase of the Die Typing Corp'n plant at Pontiac. Dostal, General Manager of the new company, has associated with him as principal though inactive partners, **Julian G. McIntosh**, Detroit Attorney, and **J. A. McIntosh**, President of the McIntosh Stamping Corp'n.

CARBOLOY CO., INC., Detroit, has authorized the Machinists' Tool & Supply Co., Los Angeles, as distributors in the So. Calif. area, and The Manufacturers Rubber & Supply Co., Akron, for the N. Central Ohio region.

GIDDINGS & LEWIS MACHINE TOOL CO., Fond du Lac, Wis., has acquired the Davis Boring Tool Div., Larkin Packer Co., Inc., St. Louis, Mo. Giddings & Lewis now produce all the standard and special boring bars and cutters formerly made by the Davis Div., the while continuing to manufacture the G & L line of horizontal boring, drilling and milling machines.

Keith H. Bliss has been named Sales Engineer in the Chicago office of **THE H. M. HARPER CO.** A graduate of Ohio State University, Mr. Bliss was formerly associated with Warner and Swasey Co., Cleveland, and later General Manager and in charge of manufacture and distribution of radio antenna disconnect switches for Powercraft Corp'n, St. Louis.

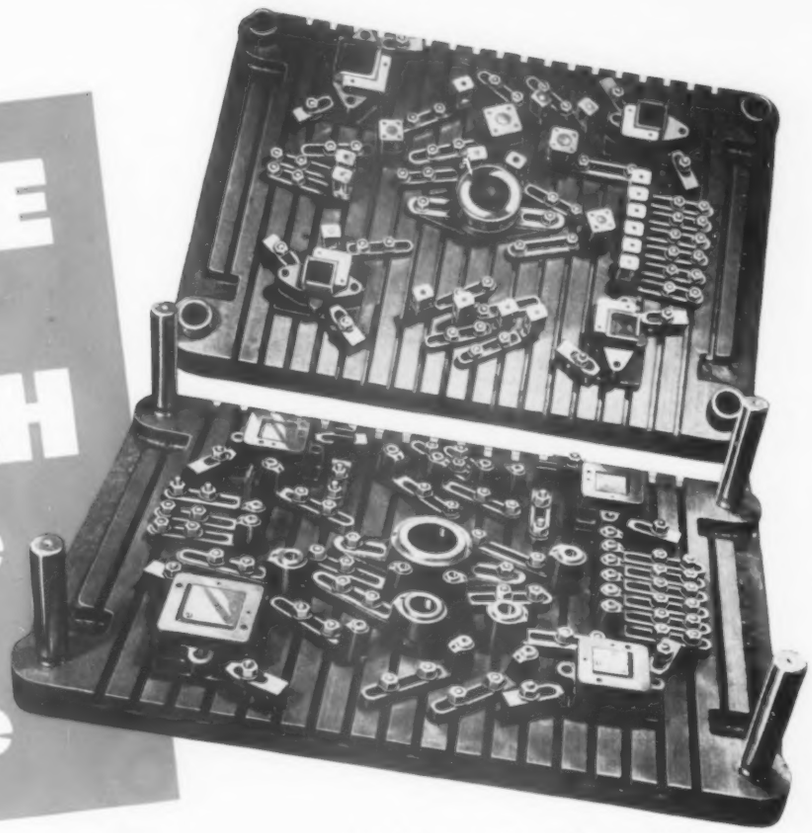
Harry L. Wise

At its recent first stockholders meeting, **SUPERDRAULIC CORPORATION** elected a board of directors including **Harry L. Wise**, subsequently appointed President and Gen'l Mgr.; **Rob't W. Wise**, Treas'r; **James F. Hoffer**, Vice-Pres. in chg. of Eng'g; **Ted Nagle**, Vice-President-director of sales and advertising, and **John R. Davis**, Sec'y. Other directors elected where **Luke C. Leonard, Lloyd I. LaDriere** and **George P. Grutsis.**

Organized to manufacture hydraulic pumps, fluid motors and transmissions, the company has started manufacture of a hydraulic pump that, while only 9" in diameter, develops 5000 lbs. psi and 40 hp—or about double the pressure and horsepower usually available in pumps of similar size.

Appointment of **Carl E. Nagel**, veteran of World War II, as Manager of Editorial Service has been announced by Charles A. Scarlott, Manager of Engineering Publications, **WESTINGHOUSE ELECTRIC CORP'N**, Pittsburgh, Pa. A graduate of Stanford University, Mr. Nagel worked successively for James McCreery Co. and the Champlain Div. of the Interchemical Corp'n, before joining Westinghouse Editorial Service in 1941. He continued in that activity until entering the Navy in '43. Mr. Nagel will be responsible for Westinghouse's technical and trade magazine articles.

PIERCE and NOTCH at the same time



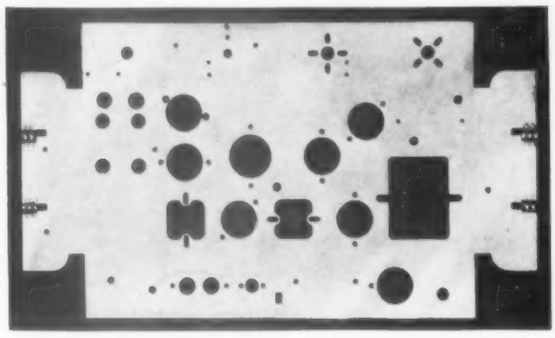
A typical set-up for notching and piercing.

with

WHISTLER

MULTI-USE Adjustable Dies

Pierced and notched with Whistler multi-use adjustable dies.



You save press time and speed production by combining corner notching dies and group dies in the same set-up with adjustable piercing dies. Press operations are reduced to a minimum. Engineering changes effecting relocation or sizes of holes can be made without delay right on the press.

Whistler multi-use adjustable dies are available from stock... a day or two from your plant ...in all standard sizes from 1/32" to 3" diameters...round, square, ovals and rectangles. Notching and group dies to order. In addition to mighty attractive savings in original die costs there is this important advantage of eliminating weeks of production delay.

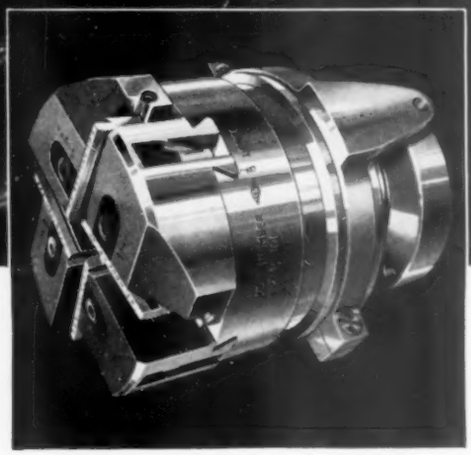
Re-arrange Whistler multi-use adjustable dies in as many different set-ups as your production calls for... you actually make up die sets from units in stock and reduce costs per job to an unbelievably low figure. All parts of like size are interchangeable.

Get all the facts on how Whistler adjustable dies can speed *your* production...cut *your* costs. Write today for the Whistler Catalogs.

S. B. WHISTLER & SONS, Inc.
752-756 MILITARY ROAD BUFFALO 17, N. Y.

WHISTLER MULTI-USE ADJUSTABLE PERFORATING DIES

Courtesy Sperry Gyroscope Company



for threading small parts . . .

Manufacturers of precision control instruments find the Landis Threading Machine and the 7/8" Lanco Hardened and Ground Head ideally suited for the threading of small vital parts on a high production basis and to close tolerance specifications.

Write for Bulletin F-80

LANDIS MACHINE COMPANY

WAYNESBORO • PENNA • U·S·A·

THREAD CUTTING MACHINES • DIE HEADS • COLLAPSIBLE TAPS • THREAD GRINDER

"Metal Fabricating Costs Expected to Increase 25% over 1939" ... "STEEL" Magazine 1946

but YOU CAN GET YOUR MACHINING COSTS DOWN with TECO Cemented Carbide

Get

- MORE PIECES BETWEEN GRINDS
- MORE GRINDS PER TOOL
- LESS DOWN TIME
- LOWER TOOL COST

TECO Cemented Carbide combines hardness, toughness and breakage resistance to a degree never before obtained in a cutting material. It holds a cutting edge longer and produces far more work than any similar material.

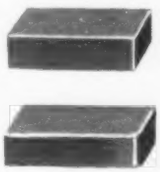
To prove how TECO gets machinery costs down to rock bottom—make this convincing test: Replace a few of your present carbide tools, on any job, with harder, tougher, more uniform TECO. Then check the output per tool. You'll get a new idea of what a carbide cutting tool can do!

TECO Cemented Carbide Tools, in all standard grades, sizes and styles, are available for immediate shipment. Latest catalog and price list sent on request.

TECO
CEMENTED CARBIDE
Pioneers in Tungsten Carbides for over a Quarter Century

TECO Cemented Carbide Blanks

Immediate delivery on full range of standard sizes, grades and styles.



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AND SPECIAL MACHINERY

HENRY & HUTCHINSON, INC.

DECATUR (ATLANTA), GEORGIA

PRODUCTION ILLUSTRATORS **TOOL PLANNERS** **PRODUCTION ENGINEERS**

THE BIG THREE

★ **THE BIG THREE** amount to a policy which we have maintained throughout 16 years of designing and building tools for industry.

If you are interested in tools that measure up to these standards, we will be glad to receive your inquiry.

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Manufacturers of "Quality" Products

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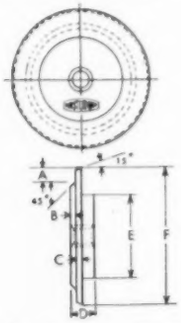
UP TO 500% **MASTERFORM** MASTERCASED LONGER LIFE

GROUND CIRCULAR CUT-OFF TOOLS

FOR BROWN AND SHARPE Screw Machines. Made in special-to-order and stock sizes (see below), ready for prompt shipments.

Masterform cut-off tools are made from specially selected high speed steel, carefully hardened and ground to a high polish. Mastercasing, the Masterform process of super-heat-treating, assures more production and 500% LONGER LIFE.



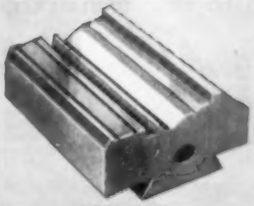
Designed to cut off .005 post center with 1/64 corner break.

ORDER BY CAT. NO.	FOR USE ON MACHINE NO.	STOCK DIA.	A	B	C	D	E	F	PRICE EACH
00-30	00	1/16	.029	1 16	.030	1 4	1 27 64	1.750	4.00
00-40	00	1/8	.0635	1 16	.040	1 4	1 23 64	1.750	4.00
00-50	00	3 16	.0975	1 16	.050	1 4	1 19 64	1.750	4.00
00-60	00	1/4	.131	1 16	.060	1 4	1 19 64	1.750	4.00
00-80	00	3/8	.1985	1 16	.080	1 4	1 15 16	1.750	4.00
0-60	0	3 8	.1935	3 32	.060	5 16	1 5 8	2.250	4.50
0-80	0	1 2	.261	3 32	.080	5 16	1 5 8	2.250	4.50
0-90	0	5 8	.3265	3 32	.090	5 16	1 5 8	2.250	4.50
2-60	2	3 8	.1935	1 8	.060	3 8	2 7 32	3.000	5.60
2-90	2	5 8	.3265	1 8	.090	3 8	2 7 32	3.000	5.60
2-125	2	1	.5234	3 32	.125	3 8	1 29 32	3.000	5.60
2-156	2	1	.5318	3 32	.156	3 8	1 29 32	3.000	5.60

LOOK

TO MASTERFORM

FOR BOTH STOCK SIZES AND *Special* TO ORDER CUTTING TOOLS



DOVETAIL FORMING TOOL

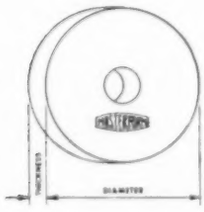
CIRCULAR FORMING TOOL

HIGH SPEED CIRCULAR TOOL BLANKS

FOR FORMING AND CUTTING-OFF TOOL USE

Made from a selected grade high speed steel, these tools are for use on circular cross slide tool posts of Brown & Sharpe automatic screw machines. These blanks are turned, drilled and tapped to fit tool post clamping screws. Blanks are either furnished soft as machined, or hardened and ground on two sides.

When ordering, please specify whether hard or soft blanks are desired, also diameter or machine number and thickness. Carried in stock for prompt shipment.



Tool blanks for other makes of screw machines can be furnished on special order.

FOR MACHINE NUMBER	DIA. INCHES	THICKNESS INCHES	NET PRICES SOFT BLANKS 1-6	SOFT BLANKS 7-12	HARD BLANKS 1-6	HARD BLANKS 7-12
00,00G,19 AUTO	1 3 4	1 4 to 3 8 by 16ths	1.15	1.10	1.45	1.41
00,00G,19 AUTO	1 3 4	7 16 to 5 8 by 16ths	1.35	1.30	1.71	1.65
00,00G,19 AUTO	1 3 4	11 16 to 7 8 by 16ths	1.75	1.70	2.20	2.15
00,00G,19 AUTO	1 3 4	15 16 to 1 by 16ths	1.80	1.75	2.25	2.20
0 and 0G AUTO	2 1 4	1 4 to 3 8 by 16ths	1.30	1.25	1.67	1.61
0 and 0G AUTO	2 1 4	7 16 to 5 8 by 16ths	1.75	1.70	2.22	2.15
0 and 0G AUTO	2 1 4	11 16 to 7 8 by 16ths	2.15	2.10	2.75	2.68
0 and 0G AUTO	2 1/4	15 16 to 1 1 8 by 16ths	2.45	2.40	3.18	3.10
2 and 2G AUTO	3	1 4 to 3 8 by 16ths	1.80	1.75	2.24	2.17
2 and 2G AUTO	3	7 16 to 5 8 by 16ths	2.50	2.45	3.14	3.06
2 and 2G AUTO	3	11 16 to 7 8 by 16ths	3.15	3.10	4.00	3.92
2 and 2G AUTO	3	15 16 to 1 1 4 by 16ths	3.65	3.60	4.65	4.57

LARGER AND SPECIAL SIZES FURNISHED ON SPECIAL ORDER
UNLESS OTHERWISE SPECIFIED, SOFT BLANKS WILL BE FURNISHED

MASTERFORM TOOL CO.

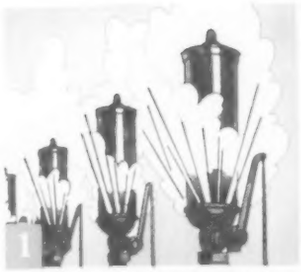
2550 IRVING PARK ROAD • CHICAGO 18, ILL.

Manufacturer and Designer of

Circular, Dovetail and Flat Forming Tools
Counterbores
Cut-Off Tools
Recessing Tools
Reamers
Forming Tool Blanks
Cast Metal Alloy Tool Bits & Associated Products

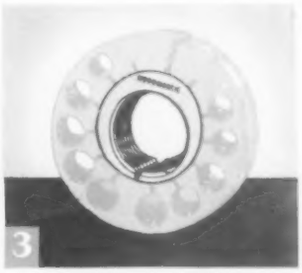
ORDER FROM OUR FACTORY REPRESENTATIVE *(There's one near you)* OR FROM US

Holy Smokes! They've done it again!



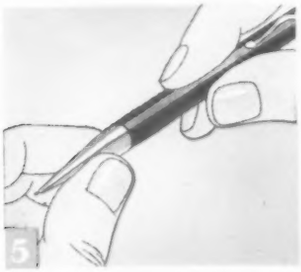
Blow all the whistles! They've done it again!

Blast out a fanfare for a great new Woodworth invention!

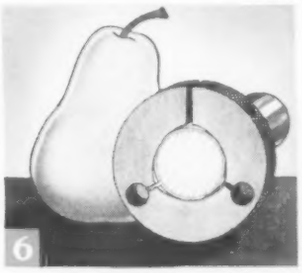


It's the Woodworth Adjustable Thread Ring Gage.

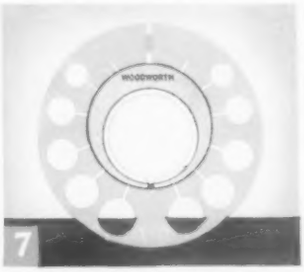
Thread ring gages check the O.D. of threaded parts.



Adjusting 'em as they wear down saves time and money.

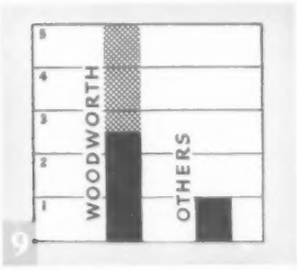


But old types get pear-shaped —lose accuracy—wear out fast.

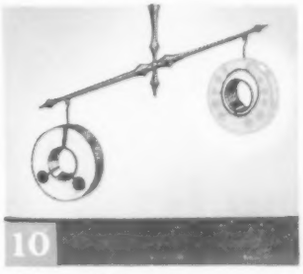


This Thread Ring Gage adjusts perfectly — *stays round.*

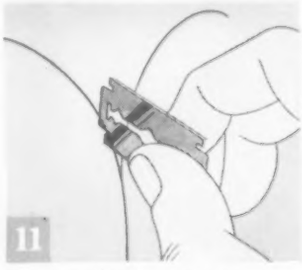
Never gets out of line when dropped or thrown about.



Equal distribution of wear increases life 2½ to 5 times.



Light weight reduces operator fatigue — increases sensitivity.



It's amazingly accurate . . . ideal for hair-splitting work.

Woodworth's New Thread Ring Gage is an all-time champion!

Another Woodworth contribution to production

THE NEW Adjustable Thread Ring Gage, another revolutionary Woodworth instrument of accuracy, is now available to industry!

Employing an entirely new principle of design, and proven mathematically correct by actual tests, this gage assures roundness through the maximum range of adjustment.

Check these
Five Important Advantages

1. *Greater Accuracy and Stability.* Stays round with adjustment. Threads held in alignment of thread helix angle with adjustment. Will not reject parts that should pass inspection.

2. *Longer Wear Life.* Equal distribution of wear over the full thread circumference, throughout the entire range of adjustment, increases wear life 2½ to 5 times.

3. *Less Weight.* Aluminum alloy outer body halves the weight to greatly reduce operator fatigue and increase sensitivity.

4. *Positive Identification.* Green outer body for GO GAGE and red for NOT GO GAGE saves time for operator.

5. *Positive Adjustment.* Cannot be thrown out of adjustment by ordinary blows or falls that change setting of conventional gages.

You can speed up production and decrease gaging costs on your thread inspection operations with this amazing instrument! Write for completely illustrated folder 46-R.

ACCURACY YOU W CAN TRUST

WOODWORTH

N. A. WOODWORTH CO., SALES DIVISION, 1300 E. NINE MILE ROAD
DETROIT 20, MICHIGAN

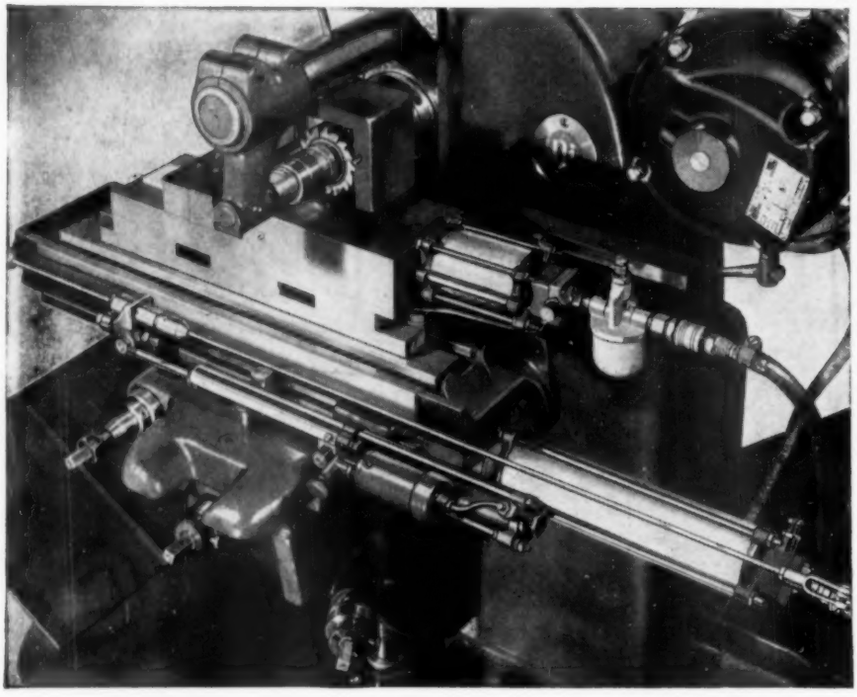
PRECISION GAGES

PRECISION MACHINED PARTS

DIAPHRAGM CHUCKS—SPECIAL TOOLS

ADJUSTABLE CLAMPING JIGS

More power to you
More speed to you
More profit to you



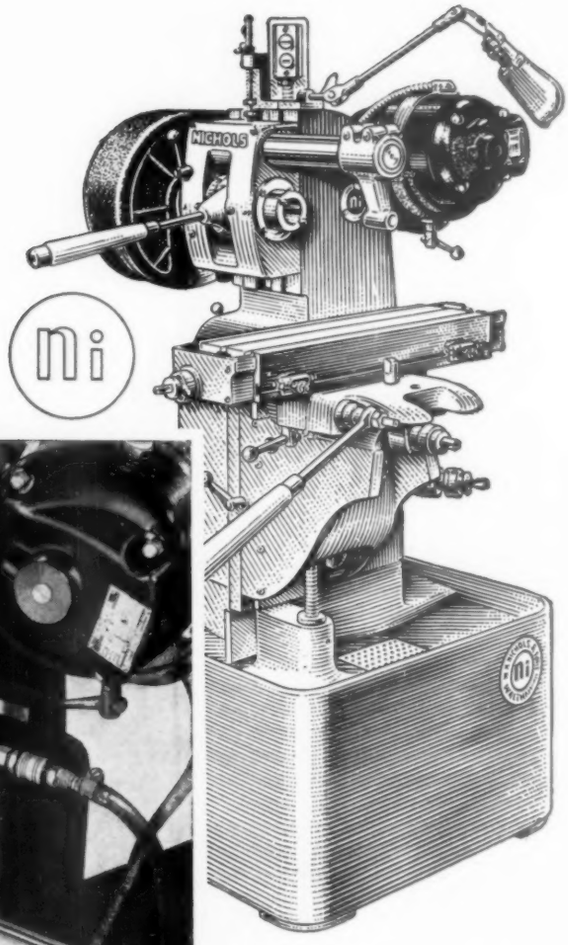


Photo shows Nichols power feed attachment installed. In this case, work is held in an air-operated vise

...with the *New Nichols* Power Feed Attachment

Here is a tested and proved power feed attachment that is an added production asset for *any* Nichols Miller. It is designed to reduce the time of the operating cycle and reduce the operator's duties so that often one operator can run two or more machines.

This power feed attachment is designed for fast table advance — maximum proper cutting feed — fast table return — automatic shut-off. It is completely automatic except for loading and unloading the work. Rapid traverse and work speeds are easily and quickly changed to suit all classes of jobs within the capacity of the machine.

Basically this attachment is a Bellows air feed unit used in conjunction with a Hydro-Check. Thus a positive, infinitely variable feed is obtained throughout the 9" maximum cutting stroke by using regular shop air lines with 75 to 175 lbs. pressure.

The Nichols power feed attachment can be installed either before or after shipment of the Nichols Miller. *It can be installed quickly on any Nichols Miller ever built.* Write for details.

Send for free Nichols Miller Catalog

THE *Nichols* MILLER

MANUFACTURED BY W. H. NICHOLS & SONS, WALTHAM, MASSACHUSETTS

NATIONAL DISTRIBUTORS: NICHOLS-MORRIS CORP., 46 CHURCH ST., NEW YORK 7, N. Y.

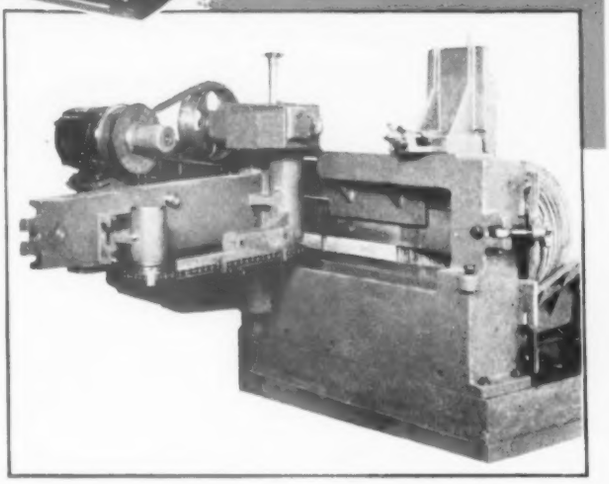
MAINTAINING PROFITS...

An Improved Product Now Costs Less

BESLY GRINDERS

● *Above:* No. "253-42" Double Spindle Besly Grinder equipped for grinding cast iron piston rings. This is used with chain feeder and vibrator-operated trough.

● *At Right:* Chain feeder. Note accessibility of feeding chains and ease of adjustment for rings of different diameters. Vibrator trough appears at extreme right.



Accuracy previously considered impossible in high speed grinding is now achieved with this Besly Grinder—due to great rigidity and larger grinding members. For instance, on automotive size piston rings, a "253-42" Besly Grinder attains a speed of 500 passes a minute. In spite of this high rate, rings are held within .0003 for size, flatness and parallelism—with a 10 to 12 micro-inch finish. Oil is used as a coolant. Power truing device employs either diamonds or cutters. Grinding wheel adjustments are quickly and easily made with conveniently located push button controls.

Besly engineers are ready to discuss with you the many possible applications of highly-specialized Besly Grinders to the improvement in your product and the reduction of manufacturing costs. Write us today!

If you are considering a BESLY GRINDER from U. S. Government Surplus Stocks...
Ask us to help you select and adapt such machines to meet the specific needs of your production. Many of these machines were originally *specials* and are not suitable for general work.

BESLY

BESLY GRINDERS AND ACCESSORIES
BESLY TAPS • BESLY TITAN ABRASIVE WHEELS

CHARLES H. BESLY AND COMPANY, 118-124 N. Clinton St., Chicago 6, Ill. • Factory: Beloit, Wis.

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Covering such subjects as:

Principles of broaching . . . Broach Design . . . Getting the Most Out of Your Broaches . . . When to Use Broaching . . . "Broaching at Work" on large parts and small, internal and surface broaching, large runs and short runs . . . Broach types; specifications . . . Selecting broach length . . . Spline broaching . . . Broaching machines . . . Fixtures for Broaching . . . Pullers . . . Broach gages . . . Broach handling and sharpening.

In preparation for over two years. Designed to be the most complete manual and catalog on broaching and broaching equipment available.

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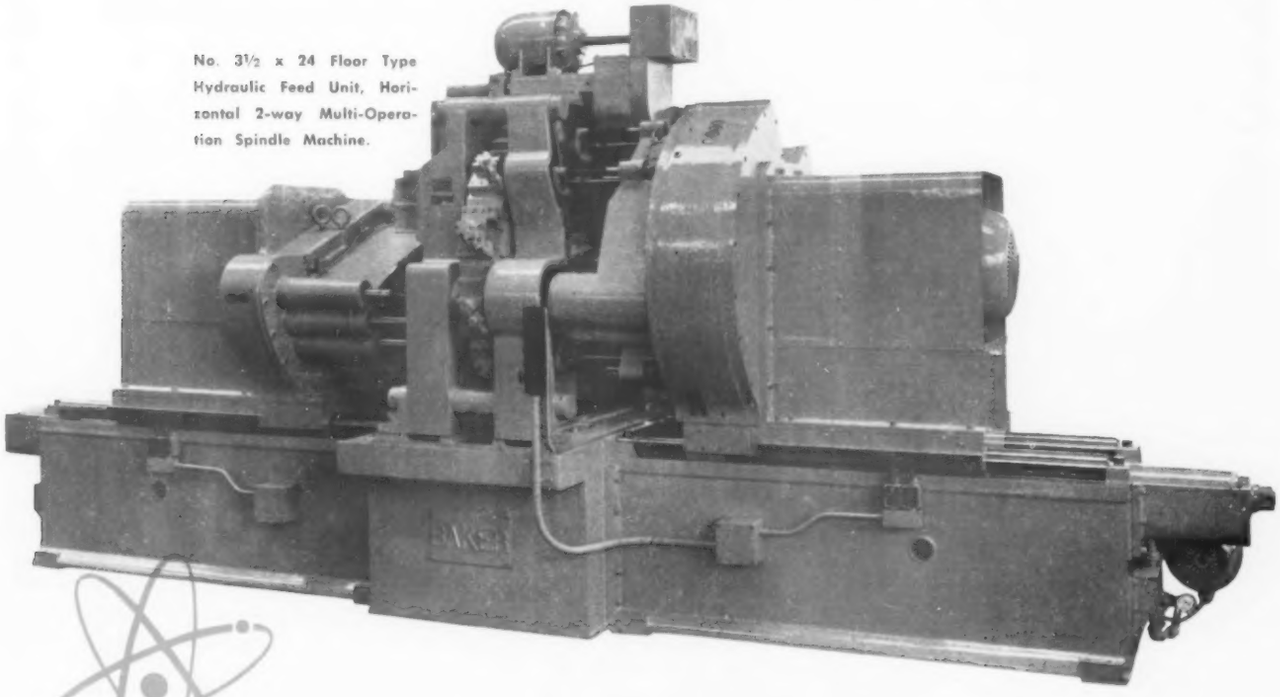
DETROIT 13, U.S.A.
Broaches / Broaching Machines - Broaching Equipment

POST WAR MANUFACTURING

requires

multi-operation machines to reduce costs and speed up production schedules. Baker Brothers specialize in heavy duty machines allowing automatic indexed multiple operations at one chucking. For instance, Model 3½ x 24 illustrated here has a 22-spindle head on the right unit and a 7-spindle head on the left. The saddles are mounted on four nitralloy bars after an original design that reduces wear decidedly. The 12-station power automatic index trunnion work-holding fixture allows load and unload at chucking position, and carries the work accurately to the 11 cutting stations. Built for extra-heavy-duty operations in alloy steel, this is a typical example of Baker engineering. For free consultation on your production problems, write or wire us today.



No. 3½ x 24 Floor Type Hydraulic Feed Unit, Horizontal 2-way Multi-Operation Spindle Machine.

Baker Bros. Inc. Toledo 10, Ohio

MIDVALE CARBON TOOL STEELS

Midvale straight carbon tool steels are produced under the most rigid control during all phases of manufacture. Their uniform hardenability, finish and performance from lot to lot are unexcelled. That's why you can be sure of consistently good results. They are available from stock in a wide variety of carbon ranges and in all usual sizes and shapes. Prompt mill delivery can be made on items not regularly carried in stock.

THE MIDVALE COMPANY • NICETOWN • PHILADELPHIA

OFFICES: NEW YORK • CHICAGO • PITTSBURGH
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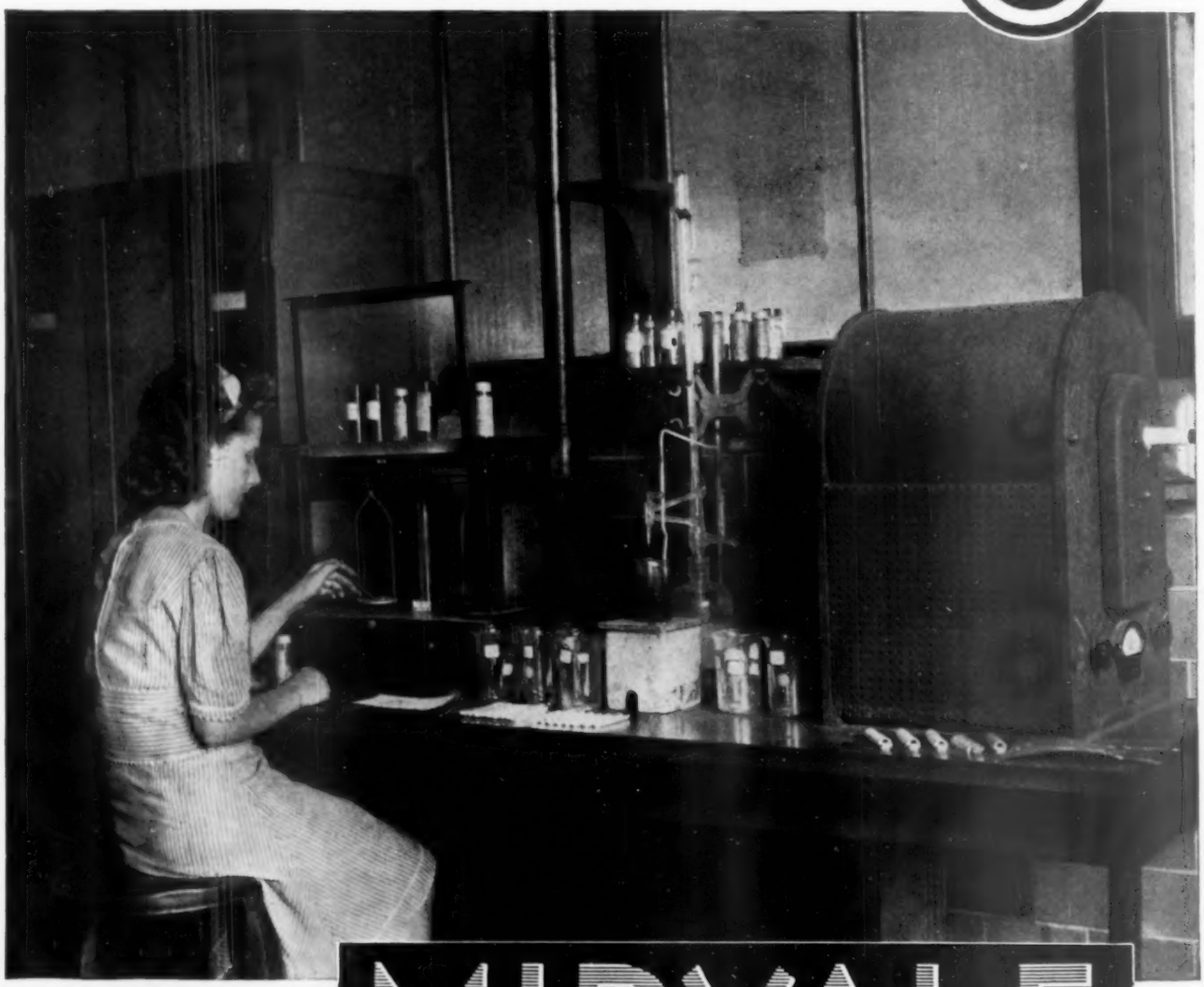


One of eight plants to retain original Navy "E"

MIDVALE

Custom Steel Makers to Industry

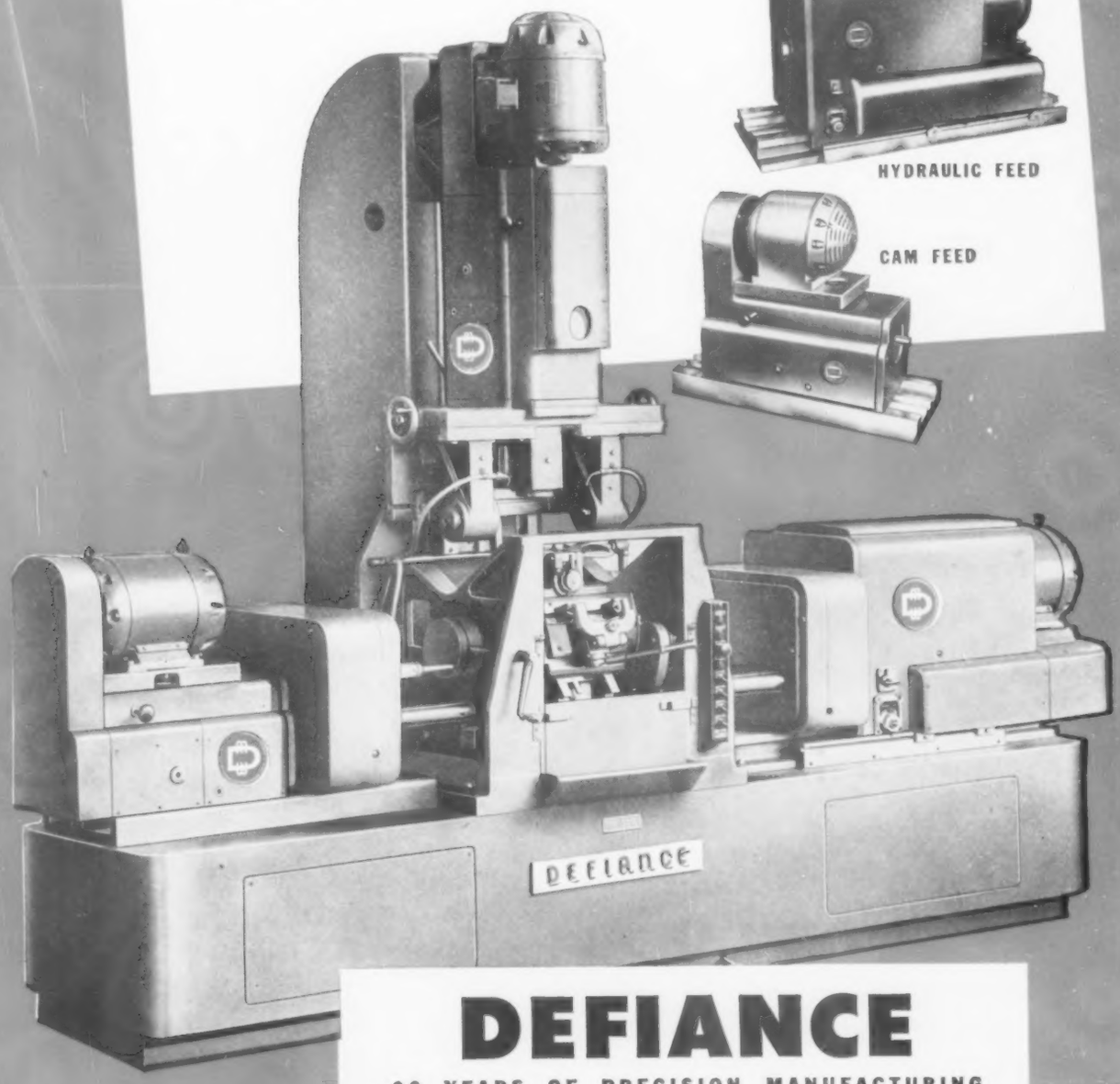
Versatile DRILL UNITS FOR HIGH PRODUCTION!

A wide range of precision drilling jobs can be performed with *high speed* and *efficiency* . . . using Defiance Production Drilling Units adapted to a production machine. A typical installation is shown here—it is a three-way machine with five station indexing fixture.

These newly developed, greatly improved Defiance Cam and Hydraulic Units are available with standardized base and column design—for either horizontal or vertical mounting. Bases and columns are of welded steel to dimensions required by individual job. Fixtures are also specially designed for each job. Defiance accuracy and dependability throughout. Write for bulletin. Defiance Machine Works, Inc., Defiance, Ohio.

HYDRAULIC FEED

CAM FEED



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96 YEARS OF PRECISION MANUFACTURING

TAPS WITH DRILL OR REAMING SECTIONS
LONG TAPS AND SHORT TAPS
TAPS WITH SHORT OR LONG CHAMFER
STEPPED TAPS AND STRAIGHT TAPS
LARGE TAPS AND SMALL TAPS
SPIRAL POINTED OR INTERRUPTED THREAD TAPS
ALL KINDS OF TAPERED TAPS
• GROUND TAPS •
THREAD MILLING CUTTERS •
THREAD GAGES & SPECIAL THREADING TOOLS, MACHINES AND CHECKERS •
You can recondition all these taps ON A
DETROIT

TAP RECONDITIONER

Having one of these DETROIT 4 in 1 tap reconditioners in your shop is just like getting an almost unlimited supply of NEW TAPS for next to nothing. With this simple low cost machine you can quickly put your worn taps back in first class condition. The machine will chamfer the taps, grind from 2 to 6 flutes, spiral point them where required and polish the points. Pays for itself in a remarkably short time. Write today for complete descriptive Bulletin #DTR-3.

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POWER-DRIVE SMALL SCREWS *Fast!*

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Plastic Products
Automatic Counting Devices
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Thermostats
Electronic Controls
Alarm Clocks
...many other products

ARO does it *first* again—introducing the *first and only* power screw driver specifically built for small screws!

The sensational new ARO Model 7000 Screw Driver is no bigger than the average cigar! A "feather-weight" performer with big power . . . weighs only 8 oz. . . . is 4⅞" long and ¾" in diameter. Capacity No. 1 to No. 6 screws. Starts automatically—no manual throttle. Just touch it to the work and *presto*—the screw is driven!

Whatever your need in power tools . . . for screw-driving, nut-setting, drilling, grinding and scores of other production jobs . . . specify ARO! Precision-built for top-speed, trouble-free performance. Write for catalog. The Aro Equipment Corp., Bryan, Ohio.

Specify **ARO** *Pneumatic* **TOOLS**

THERE IS AN ARO JOBBER NEAR YOU!

Capacity . . .

MARVEL 18 *for Size,* MARVEL 6A and 9A *for Volume Production*

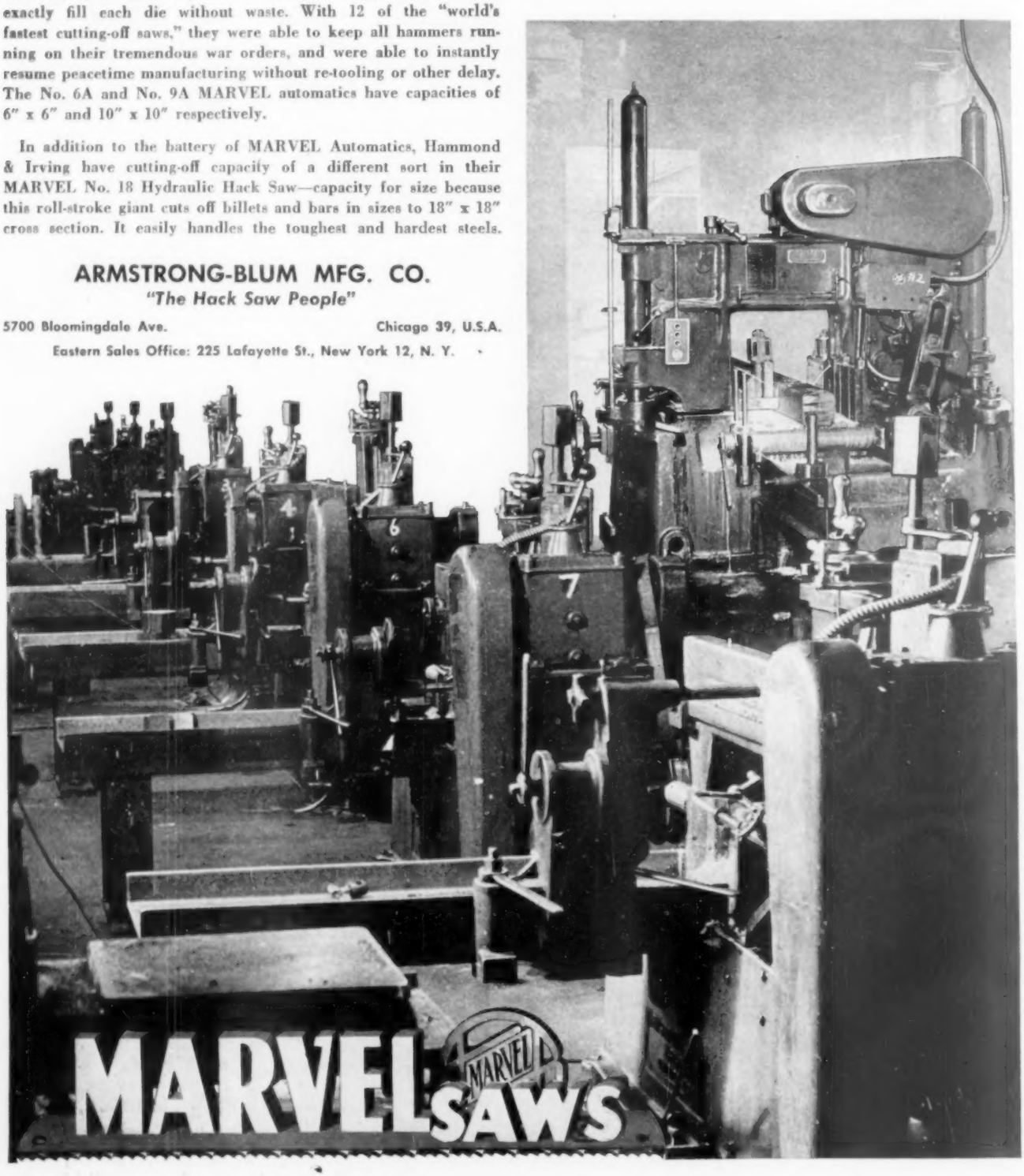
With this battery of twelve No. 6A and No. 9A MARVEL High Speed Automatic Hack Saws, the Hammond & Irving Forge Co. of Auburn, New York, can cut off billets automatically, not only in tremendous numbers, but in accurate weights and sizes to exactly fill each die without waste. With 12 of the "world's fastest cutting-off saws," they were able to keep all hammers running on their tremendous war orders, and were able to instantly resume peacetime manufacturing without re-tooling or other delay. The No. 6A and No. 9A MARVEL automatics have capacities of 6" x 6" and 10" x 10" respectively.

In addition to the battery of MARVEL Automatics, Hammond & Irving have cutting-off capacity of a different sort in their MARVEL No. 18 Hydraulic Hack Saw—capacity for size because this roll-stroke giant cuts off billets and bars in sizes to 18" x 18" cross section. It easily handles the toughest and hardest steels.

ARMSTRONG-BLUM MFG. CO.
"The Hack Saw People"

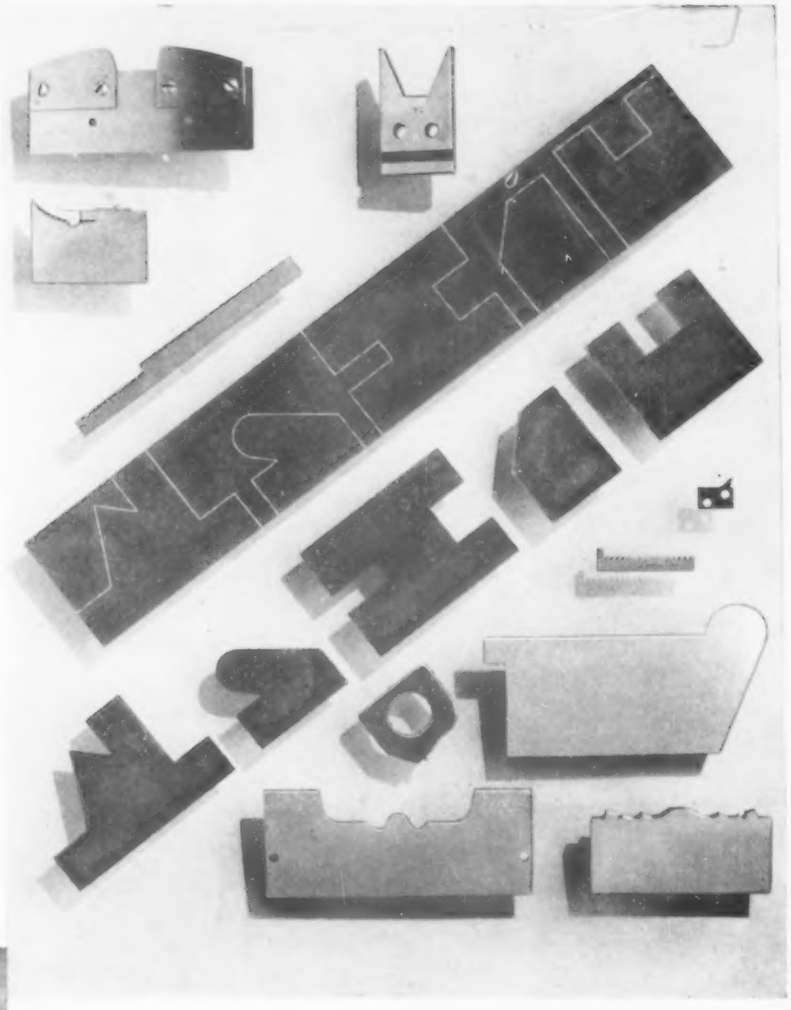
5700 Bloomingdale Ave. Chicago 39, U.S.A.

Eastern Sales Office: 225 Lafayette St., New York 12, N. Y.



FLATTEN YOUR COSTS

ON SMALL TOOLS AND PARTS



...MAKE YOUR OWN

with SIMONDS Flat Ground Stock

Save the time and money now wasted in grinding ordinary mill stock to size. Standardize on *ready-to-use* Simonds "Red Streak" Flat Ground Stock for making your own punches, dies, gages, jigs, fixtures, templates, stamps, shims, machine parts and other small items.

"Red Streak" Oil Hardening Flat Ground is made from alloy tool steel poured in Simonds Stock Mills. It's cut to 18" length . . . accurately ground to standard thicknesses within limits of plus or minus .001" . . . is squared on both edges and ends . . . and has smooth surfaces for accurate layout work. What's more, it's uniformly annealed for easy machining and proper hardening. And each piece is packed in its own protective envelope, plainly marked with size and heat-treating instructions. 121 sizes available.

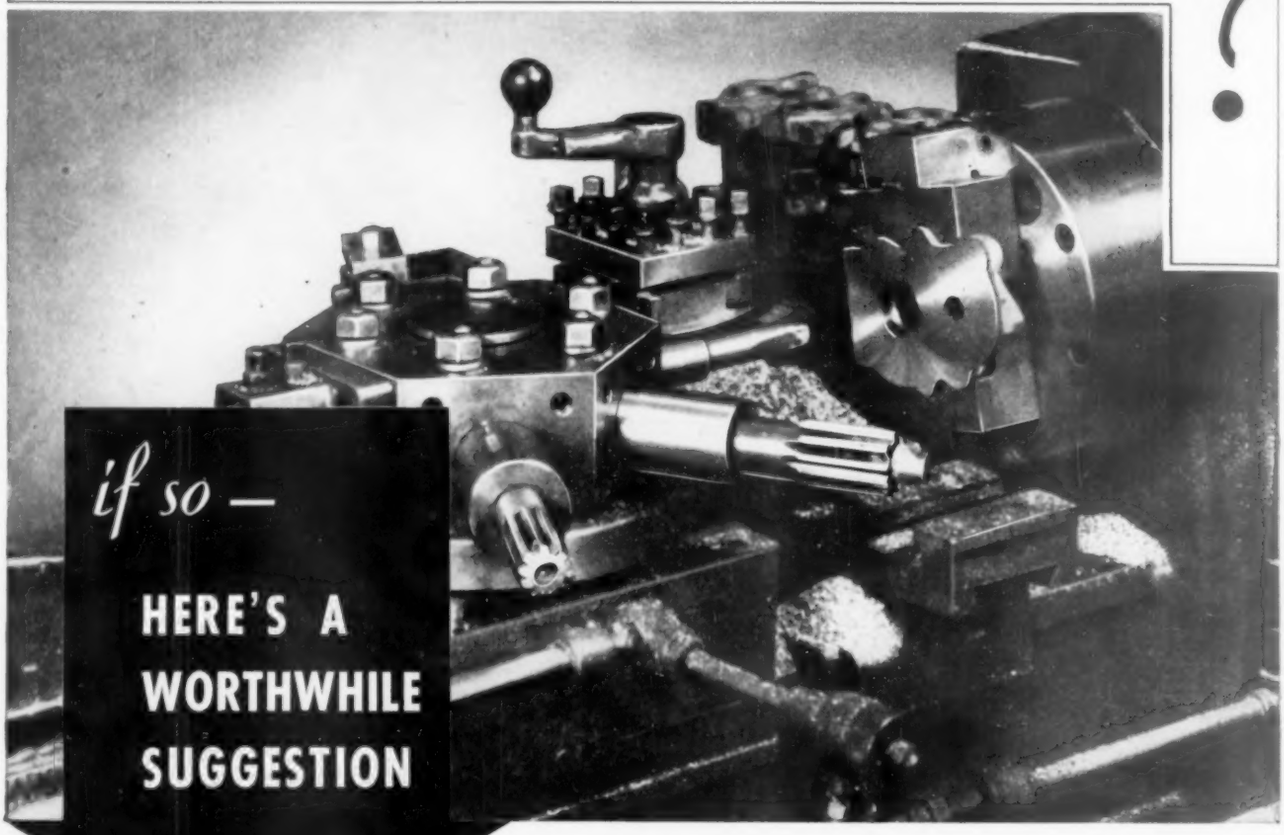
Order from your Industrial Supply Distributor, or from the nearest Simonds office, listed below, at the left.

BRANCH OFFICES: 1350 Columbia Road, Boston 27, Mass.; 127 S. Green St., Chicago 7, Ill.; 416 W. Eighth St., Los Angeles 14, Calif.; 228 First St., San Francisco 5, Cal.; 311 S. W. First Ave., Portland 4, Ore.; 31 W. Trent Ave., Spokane 8, Washington. *Canadian Factory*: 595 St. Remi St., Montreal 30, Que.

SIMONDS SAW AND STEEL CO.

FITCHBURG, MASS.

Are you concerned with *heavy duty* turret lathe operations ?



if so —

HERE'S A WORTHWHILE SUGGESTION

Cushman Heavy Duty and Extra Heavy Duty Chucks, designed and built "from the ground up" especially to meet the demands of modern turret lathe operation are equipped with American Standard 2-piece jaws and Serrated 2-piece jaws respectively. The construction of these precision chucks fully qualifies them for continuous service under heavy feeds and at high speeds with carbide tools. The two piece jaw equipment permits the use of formed soft blank top jaws...at a cost far below that of special jigs or set-ups...when irregular shaped work pieces are being machined. It is likewise easy and economical to change from one set of jaws to another without dismounting the chucks.

Whether your needs in work holding equipment are "standard" or "special" Cushman can supply a cost saving answer out of the long experience of our Engineering Department. Call upon us without obligation.

THE CUSHMAN CHUCK COMPANY • Hartford 2, Connecticut

A WORLD STANDARD FOR PRECISION

CUSHMAN CHUCKS

You can depend upon your Cushman Distributor for expert, experienced assistance in the solution of your work holding problems. Call on him.

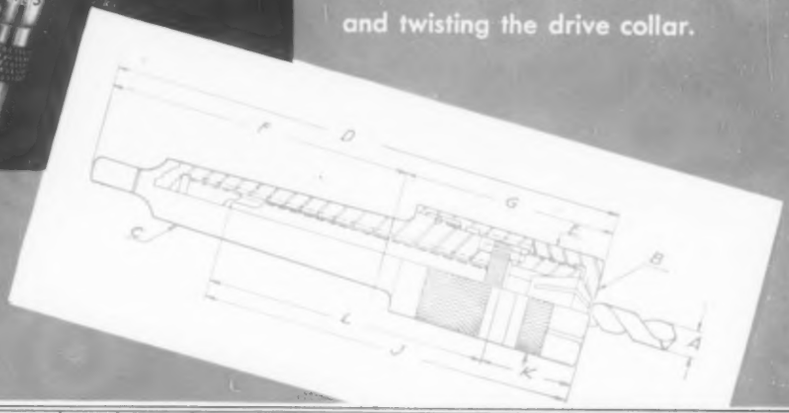
The "LONG and SHORT" of It

Scully "Feed as you Need" Chucks

WITH Scully "Feed as you Need" Chucks, you can chuck short or long series drills with only a small portion of the drill extending—thus keeping overhang at a minimum. The drill always has a positive backing against slipping into the chuck.

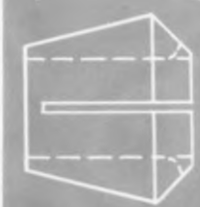
You need only half as many drills when you use Long-Series Drills for Short-Series work. The saving in Time and Tools is apparent.

The drill is adjusted for depth or overhang without releasing the chuck, by simply loosening the Collet lock nut and twisting the drive collar.



Tool Number	To Accommodate Inclusive Drill sizes	Collet No	M.T. Shank	Over-all length	Body Diameter	Shank Depth	Projection from Spindle	Depth Drill enters Chuck when completely Drawn in	Depth Drill enters Chuck when completely Extended	Total Adjustment	Price each
	A	B	C	D	E	F	G	J	K	L	$
NA-1	57 To 11/64	A	1	4 1/4	7/8	2 7/16	1 13/16	2 11/16	13/16	1 7/8	17.00
NB-2	1/8 " 9/32	B	2	5	1 1/16	2 15/16	2 1/16	3 3/8	7/8	2 1/2	21.00
NC-3	3/16 " 13/32	C	3	6 9/16	1 1/2	3 11/16	2 7/8	4 7/16	1 5/16	3 1/8	26.00
ND-4	5/16 " 9/16	D	4	7 15/16	1 7/8	4 5/8	3 5/16	5 1/2	1 5/8	3 7/8	33.00

FURTHER INFORMATION AND QUOTATIONS ON REQUEST



Collet Number	For Drill Sizes	Price each
A	57 TO 11/64	2.25
B	1/8 " 9/32	3.00
C	3/16 " 13/32	4.50
D	5/16 " 9/16	6.00

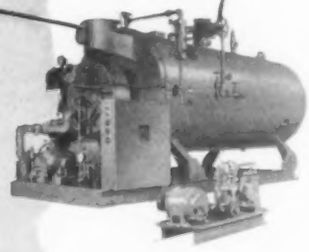
Refer to the Scully-Jones Catalog showing over 500 types and sizes of cutting tools, collet chucks, boring equipment, centers, etc.

Scully-Jones AND COMPANY

1915 SOUTH ROCKWELL STREET • CHICAGO 8, U. S. A.

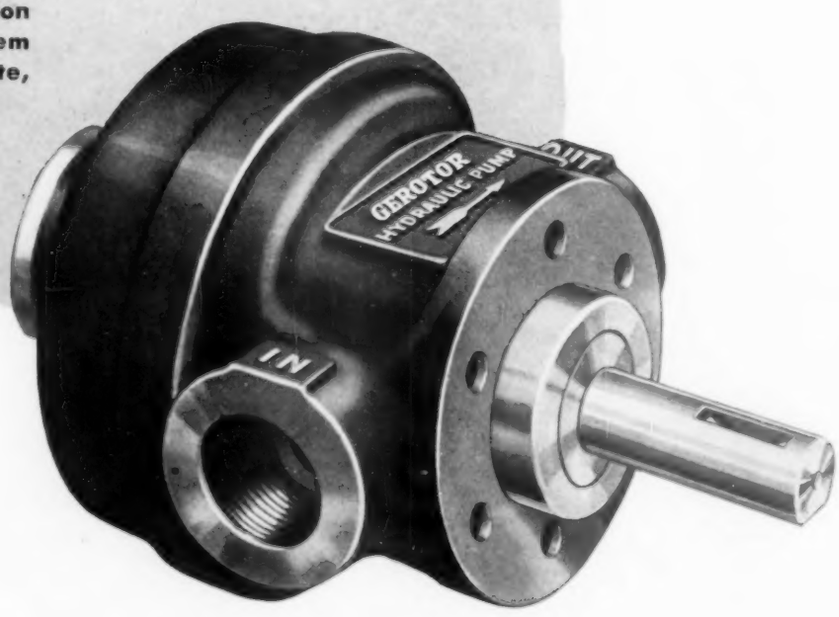
GEROTOR
HYDRAULIC PUMPS

"do a job" for CYCLOTHERM STEAM GENERATORS



Gerotor Hydraulic Pumps are taking on new tasks in many fields of peacetime industry. On Cyclotherm Steam Generators, for example, Gerotor's dependable operation eliminates the hazard of pump failure when the Cyclotherm is called on to generate steam at high efficiency.

Gerotor's unsurpassed record of top performance and low-cost operation makes it the preference of industrial leaders who have intricate pump problems. If you have a difficult hydraulic pump application, place it before Gerotor's staff of engineers. There is no obligation —no delay. Your problem will be given immediate, courteous attention.



GEROTOR MAY CORP., BALTIMORE 3, MD., Plants at Logansport, Ind., Baltimore, Md.

THE ANSWERS TO ALL YOUR NEEDS IN

TOOL AND DIE STEELS . . .

- ★ HIGH SPEED STEELS
- ★ HOT WORK STEELS
- ★ SHOCK RESISTING STEELS
- ★ COLD WORK STEELS
- ★ CARBON STEELS
- ★ HIGH SPEED AND TOOL STEEL FORGINGS
- ★ CAST-TO-SHAPE TOOL STEELS
- ★ COMPOSITE DIE STEELS

TO MEET ANY REQUIREMENTS

TODAY—and for a long time to come—the premium on production cost-saving is greater than ever before. Match up each one of your machine operations with the tool or die steel that will do the job faster, better, or with less "down" time. This new booklet gives you complete information on the exceptionally large family of Allegheny Ludlum Tool Steels—invaluable data on properties, uses, selection and handling that every production man should have.

write for your copy... **TE-41**

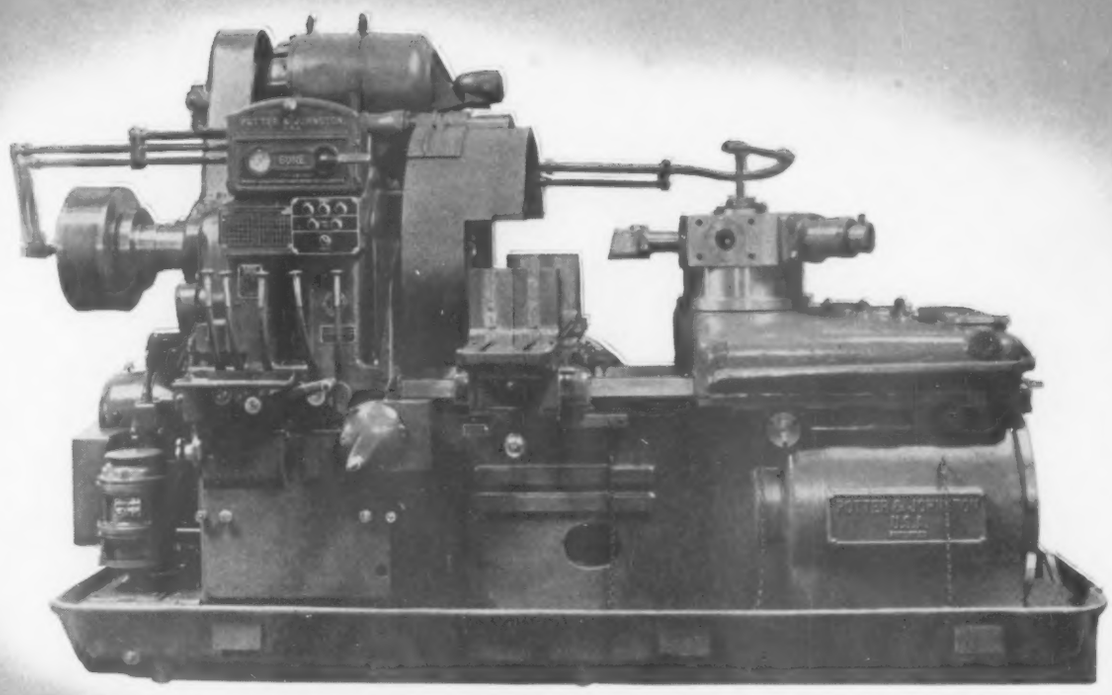
ALLEGHENY LUDLUM

STEEL CORPORATION · General Offices, Brackenridge, Pa.

Pioneer in Speciallloy Steels

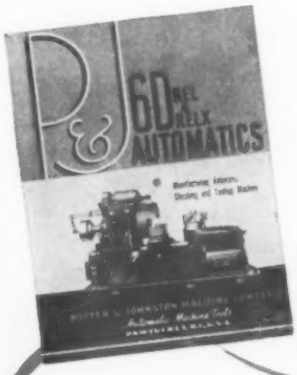
S is for Service
"S" is for the Service you receive from Winter Taps, the extra holes per grind, the clean-cut threads, the extra long useful life. "S" is also for the Service and close cooperation you receive from the Winter Brothers engineering staff in working out new tapping problems and new techniques.
WINTER
S also stands for another Service
— the prompt Service you receive from your local mill supply man who is familiar with your problems and is always ready to help you. He is as near to you as your phone. "S" also stands for the full Stock of Winter Taps he carries on his shelves ready for immediate delivery. For Service with a capital "S" always specify Winter Taps — from your local distributor.
Winter Brothers
COMPANY
Wrentham, Massachusetts, U.S.A.
BRANCH STORES
SAN FRANCISCO, CALIFORNIA · CHICAGO, ILLINOIS · DETROIT, MICHIGAN
A DIVISION OF THE NATIONAL TWIST DRILL & TOOL CO., ROCHESTER, MICHIGAN

P&J 6D *REL & RELX* AUTOMATICS



LARGE WORK *is produced in quantity* AT LOW COST *on these machines*

Every Victory Bond is a Good Buy, But More Are Better



Advanced features of design are incorporated in these machines which cut costs and simplify the production of large duplicate parts. Versatility in tooling possibilities adapts these machines for economical use on an unusually wide range of work.

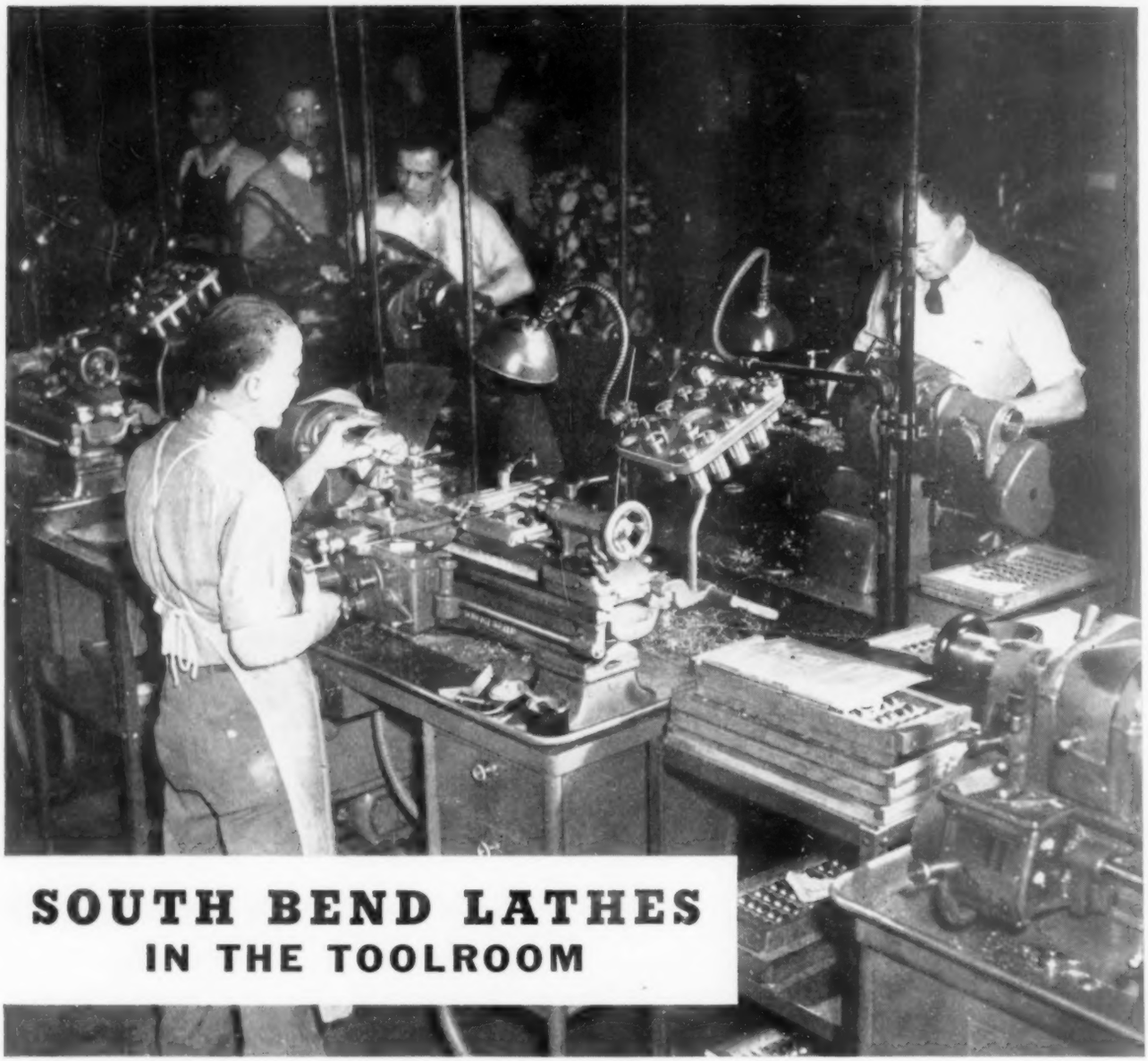
Contributing to the increased output and high quality of work produced on these machines are inherent power and rigidity together with four automatic changes of spindle speed, three selective automatic changes of feed, automatic binding of turret following index, direct cross slide action and a motor-driven constant fast motion to cross and turret slides.

These and other outstanding features are fully described in Bulletin 118 available on request.

CONDENSED SPECIFICATIONS

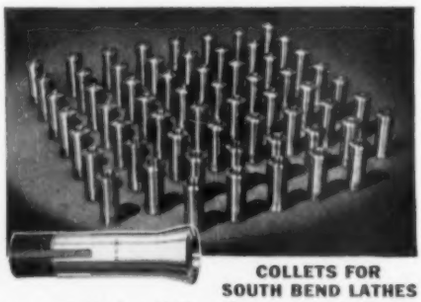
	6D REL	6D RELX
Swing over Bed	34½"	34½"
Swing over Cross Slide	21"	21"
Cross Slide Travel (either way)	8½"	6¼"
Number turret faces	5	6
Dia. hole in turret	2½"	3"
Turret Feed	13"	22¼"
Turret Slide Adjustment	10⅛"	17"

POTTER & JOHNSTON MACHINE COMPANY
Pawtucket, R. I.



SOUTH BEND LATHES
IN THE TOOLROOM

WHERE PRECISION AND PERFORMANCE COUNT!



COLLETS FOR SOUTH BEND LATHES

are available from 1/16" to 1" capacity in 1/64" steps. A complete set will help to lower your toolroom costs.

Nowhere in the plant are unfailing precision and dependable performance more important than in the toolroom. It is here—in the "tools that make the tools"—that the quality and cost of the product are largely pre-determined.

The ability of South Bend Lathes to perform a wide variety of precision operations makes them the most valuable and versatile tools in the toolroom. The ease and speed with which they can be changed from one set-up to another is a definite advantage and still another reason for their wide popularity. A complete line of attachments and accessories are available which will simplify your tooling still further. Write today for Catalog 100-D which illustrates in full color and completely describes the complete line of South Bend Engine Lathes, Toolroom Lathes and Turret Lathes.

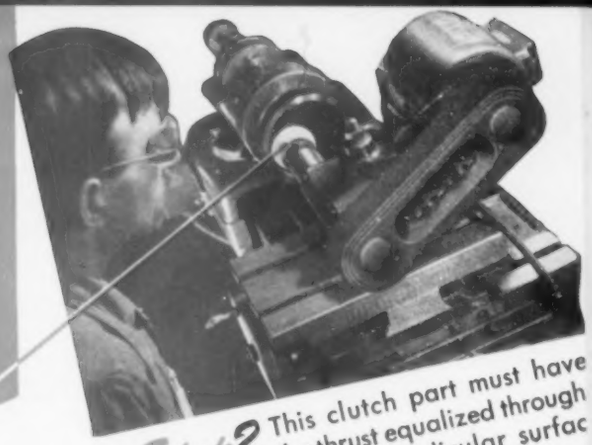
SOUTH BEND LATHE WORKS

531 EAST MADISON STREET • • SOUTH BEND 22, INDIANA

LATHE BUILDERS SINCE 1906

SURFACES GROUND... ITH ONLY 1 CHUCKING

PROBLEM—To grind three surfaces, maintaining the two concentric i. d.'s perpendicular to plane surface. 1. This ground surface must be oil-tight when assembled, with a tolerance of .0002". 2. Surface must be ground exactly perpendicular to the annular (ring) surface, tolerance, .0002". Square corner must be ground without a recess. 3. A 1" internal cylindrical surface on one half, ¾" on the other half.



Step 2 This clutch part must have the thrust equalized through out the internal, perpendicular surfac which is held to .0002".

Step 1 Spindle is set at an angle; cup wheel grinds in a concentric pattern. .0002" tolerance provides oil-tight joint.

Step 3 Spindle speed is increased to 32,500 s.f.p.m. Small wheel is used for the internal shaft hole, tolerance, .0002".

DATA **PART:** Overrunning clutch casing for a punch press. **MATERIAL:** Hyt-M70 Carbon Steel (62-64 Rockwell). **WHEELS:** Nubon W-60-K, 2" cup, 14,600 s. f. p. m. Carborundum E-60-P-100, ⅝" x ¼" x ⅛" 32,500 s. f. p. m. **GRINDER:** Dumore No. 5.

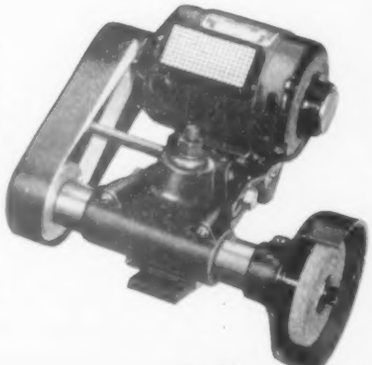
For the unusual grinding job as well as the routine . . . look to Dumore. As an example, here's how Tools, Inc., of Chicago, used a Dumore No. 5 Grinder with exceptionally fine results. Finish and accuracy were easily achieved, and there was an actual reduction in the working time involved.

The Dumore Company, Tool Division, Dept. TE43, Racine, Wisconsin. Eastern Sales and Service Branch, 13 East 40th Street, New York 14, N. Y.

DUMORE NO. 5
MASTER PRECISION GRINDER

The ½ H.P. model is the most versatile of Dumore Grinders. 11 quick-change quills for .0001" accuracy, depths to 18" and ¼" to 1⅞" diameters. 5 interchangeable pulleys for speeds of 4,600 to 42,500 r. p. m.

NO. 5 WITH B QUILL
$182.50 F. O. B. FACTORY



SEND FOR "HERE'S HOW!"

For other examples of grinding methods, ask for the new "Here's How!" Book.

DUMORE
PRECISION AND HAND GRINDERS

SOLD BY AUTHORIZED INDUSTRIAL DISTRIBUTORS IN ALL PRINCIPAL CITIES

Meet Black Giant

A New Graphitic Oil-Hardening Tool Steel

- It machines beautifully.
- Its self-lubricating qualities mean lower friction—longer life in many kinds of tools.
- Oil-hardening, it responds readily to heat-treatment—and hardens deeper than most graphitic steels.
- It has excellent non-deforming properties.

Use it for deep-drawing dies; bushings, mandrels, seaming rolls; bending and stamping dies; plug or ring gages; and a host of other tools requiring high resistance to wear and abrasion.

Black Giant does not replace BTR, Bethlehem's oil-hardening tool steel. Rather, it complements BTR in many special applications like those listed above.

TYPICAL ANALYSIS

C	Mn	Si	Cr	W
1.40	0.90	2.20	0.45	0.50

BETHLEHEM STEEL

Uniform precision — accuracy — interchangeability of parts—those are the things that make possible the economy of modern streamline production.

That kind of accuracy is easier to maintain if you have reliable gages to help you.

Gages bearing the PM Diamond Emblem are made to laboratory standards to begin with. Then they are given the smooth, hard finish that insures longer service.

We maintain large stocks of PM standard plug, ring and thread gages, as shown in the PM Catalog, and can give you immediate delivery service.

Special gages, made to your specifications, take a little longer. We'll gladly quote you prices and delivery dates.

ARMY E NAVY

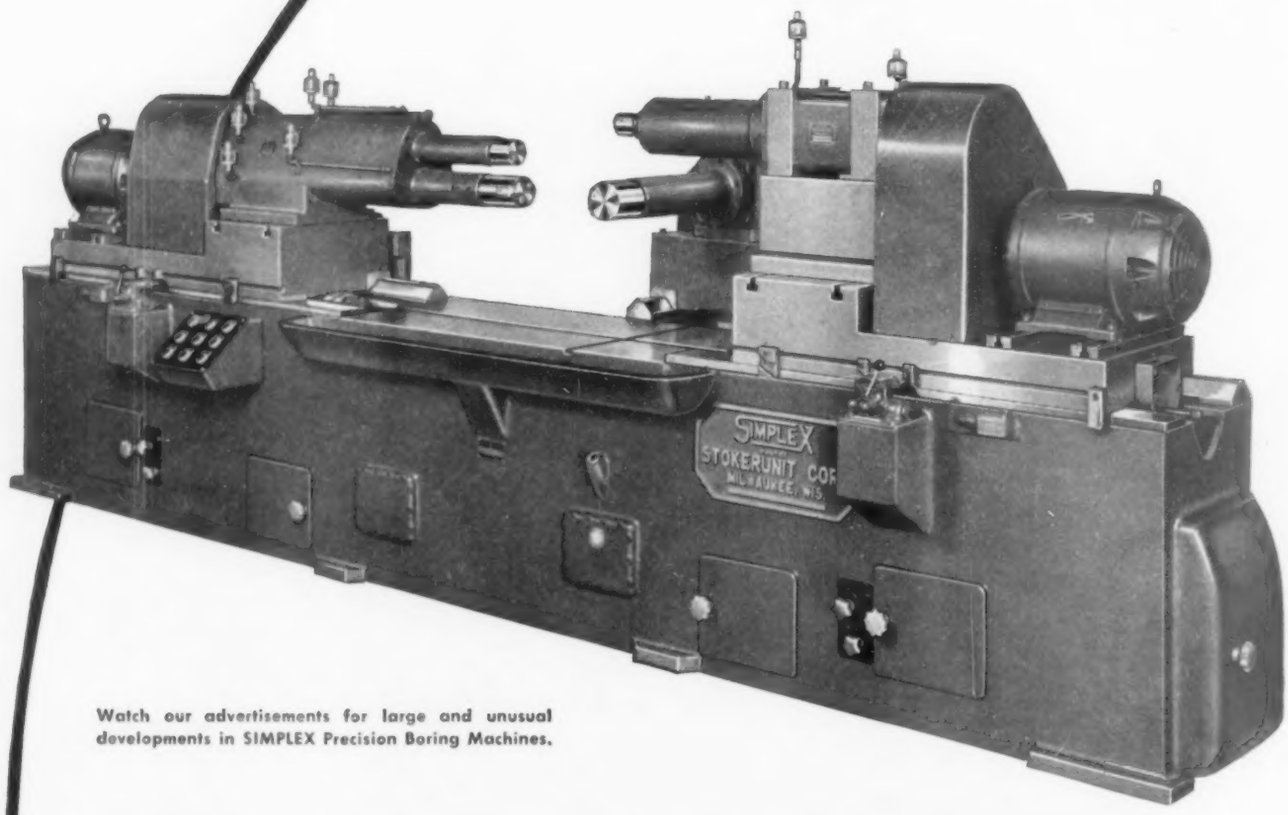
The PIPE MACHINERY COMPANY Cleveland, O.

GAGES • MULTIPLE THREAD MILLING CUTTERS • SPECIAL TOOLS

SIMPLEX

When a leading tractor manufacturer contracted to build a transmission for a military tractor, they realized they could not take any chances with Government inspection. A SIMPLEX 3U 3-way Precision Boring Machine, large enough to bore a unit 4' long, made a quick and easy job of getting them out swiftly — and right!

The transmission case was approximately rectangular, 48" long, 19" wide and 21" high. There were six bores, ranging from 2¾" to 6½". Most of them were located so deep in the casting that extension type spindle heads were necessary. With this arrangement there was very little tool overhang, accuracy was easily maintained, tool life increased, chatter avoided.



Watch our advertisements for large and unusual developments in SIMPLEX Precision Boring Machines.

Precision Boring Machines

STOKERUNIT CORPORATION

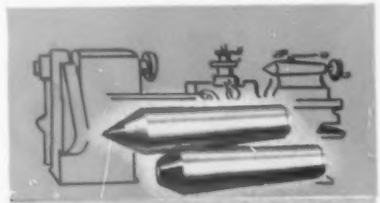
SIMPLEX Precision Boring Machines and Planer Type Milling Machines

4528 West Mitchell Street, Milwaukee 14, Wisconsin

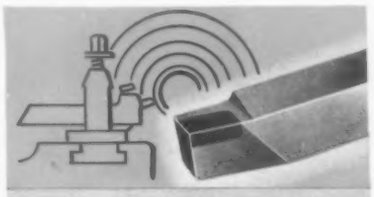
Talide
(TUNGSTEN CARBIDE)
Performance!

TALIDE METAL MEETS EVERY REQUIREMENT

A FEW MAJOR USES FOR TALIDE METAL

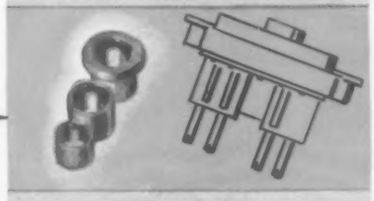

Lathe and Grinder Centers

Centerless Blades

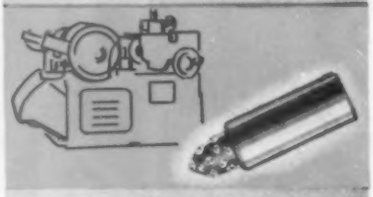

Cutting Tools

Sheet Metal Dies

Rolling Mill Work Rolls


Drill Jig Bushings

the hardest metal made!


Diamond Wheel Dressers

Plug and Ring Gages

Wire and Tube Drawing Dies

On any cutting, drawing, or wear resistance application, you can increase production many times and cut costs as much as half. Cutting tools of Talide cut 2 to 3 times faster than high speed tool steel. Talide drawing dies and wear resistance parts usually outwear steel by at least 50 to 1.

Send us parts or prints and we will show you how this hardest man-made metal can improve your production. If you prefer, a Talide sales engineer will call at your office.

Hardest man-made metal.
Highest modulus of elasticity. (double that of steel)
Extreme Density.
Low coefficient of expansion and contraction.
High compressive strength.
High red hardness.

THE ENGINEERED CARBIDE FOR ALL APPLICATIONS

TALIDE

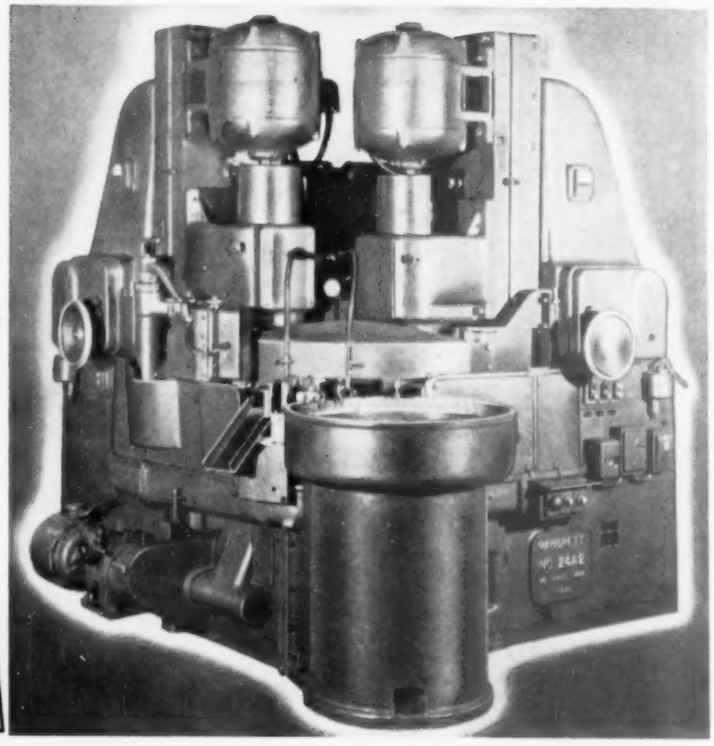
METAL CARBIDES CORPORATION

YOUNGSTOWN 5, OHIO *Pioneers in Tungsten Carbide Metallurgy*

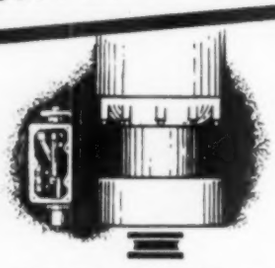
SINTERED CARBIDES FOR CUTTING • HOT PRESSED CARBIDES FOR DRAWING AND WEAR RESISTANCE

THE *Electric Arm* OF ACCURACY*

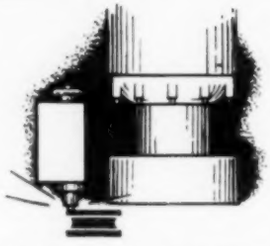
Insures Automatic Precision in HANCHETT PRODUCTION SURFACE GRINDING . . .



Automatic SIZE CONTROL ...How it works



OPERATION SEQUENCE: Work sizer B is in continuous contact with parts leaving grinding wheel.



As wheel wears, parts increase to allowable tolerance, closing sizer circuit.

Pre-Set control A feeds wheel down—holding tolerances without operator's attention.

Red light flashes when wheel is worn out. Ammeter offers check on grinding efficiency.

HANCHETT 24-A2 AUTOMATIC SURFACE GRINDER

Automatic size control, plus ammeters, push-button motor controls and built-in wheel dressers are a few of the reasons why Hanchett Rotary Automatics are tops for *fast* production of parts — from half-inch castellated nuts to engine blocks — with positive accuracy in the grind.

The Hanchett 24-A2 is the smallest of this series of automatic Production Surface Grinders. Up to five vertical grinding spindles can be mounted above the rotary table, to meet your requirements. Get complete information today!

See Your Nearest Hanchett Dealer, or Write for Bulletin 145-ITE

Represented Throughout Latin America by Machine Affiliates, Inc.

HANCHETT GRINDERS BIG RAPIDS MICHIGAN

IF IT'S A FLAT SURFACE—THERE'S A HANCHETT TO GRIND IT

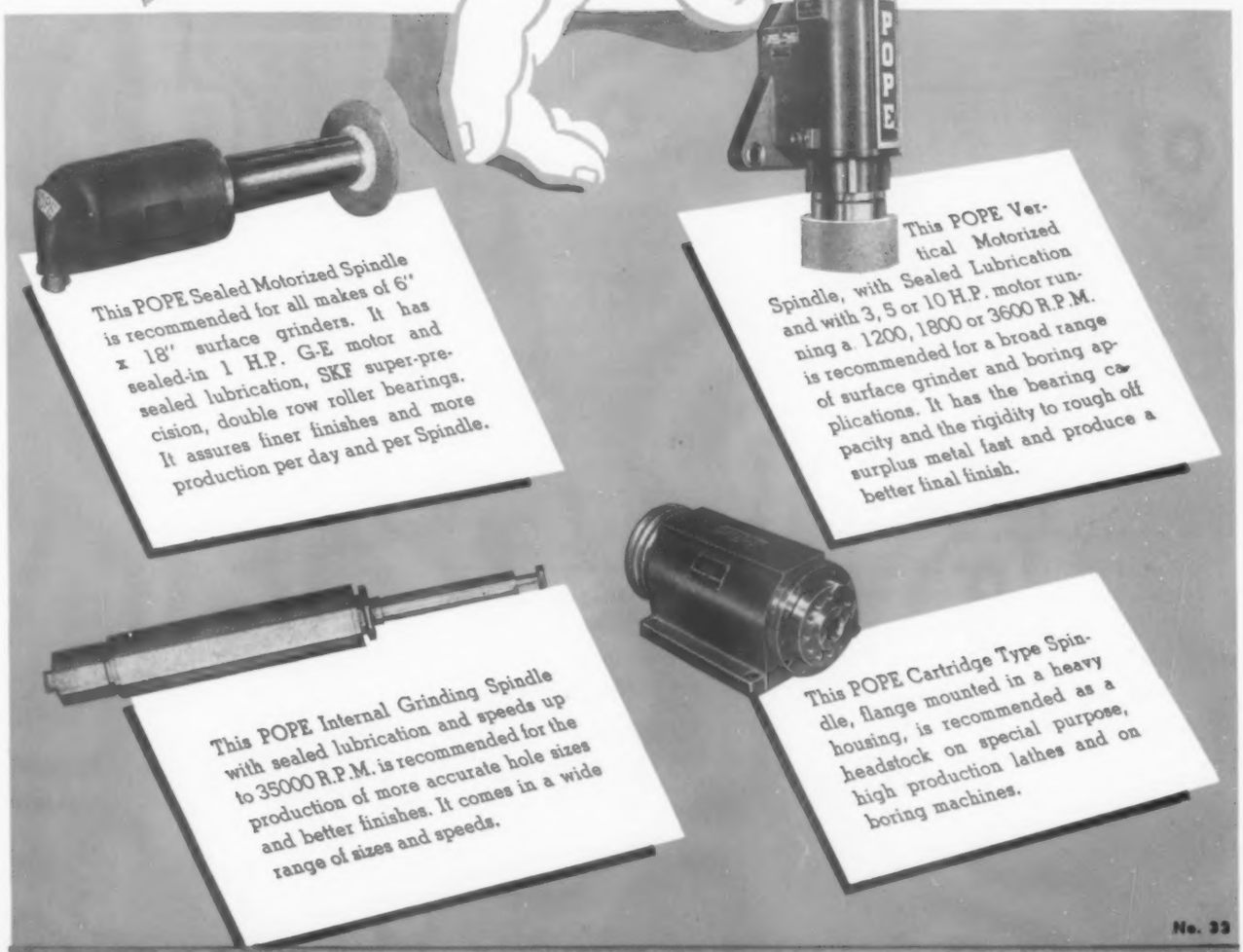
HANCHETT MANUFACTURING CO.
BIG RAPIDS, MICHIGAN U.S.A.

HANCHETT HERMETI-COIL MAGNETIC CHUCKS

ALL *You* NEED TO DO IS GET THE POPE SPINDLE THAT FITS THE JOB

Pope's large variety of types and sizes of Precision Spindles with Sealed Lubrication makes it a simple matter for you to get the right Spindle for your job. The four examples shown below give you some idea of the wide range available.

Simply send us a sketch with dimensions and the name of your machine, the method of holding the wheel or tool and the R.P.M. wanted. We will then submit recommendations with cost and delivery estimates.



These modern *"Package Units"* are complete, even to a sealed-in supply of lubricant good for the life of the bearings.

This POPE Sealed Motorized Spindle is recommended for all makes of 6" x 18" surface grinders. It has sealed-in 1 H.P. G-E motor and sealed lubrication, SKF super-precision, double row roller bearings. It assures finer finishes and more production per day and per Spindle.

This POPE Vertical Motorized Spindle, with Sealed Lubrication and with 3, 5 or 10 H.P. motor running a 1200, 1800 or 3600 R.P.M. is recommended for a broad range of surface grinder and boring applications. It has the bearing capacity and the rigidity to rough off surplus metal fast and produce a better final finish.

This POPE Internal Grinding Spindle with sealed lubrication and speeds up to 35000 R.P.M. is recommended for the production of more accurate hole sizes and better finishes. It comes in a wide range of sizes and speeds.

This POPE Cartridge Type Spindle, flange mounted in a heavy housing, is recommended as a headstock on special purpose, high production lathes and on boring machines.

No. 33

POPE

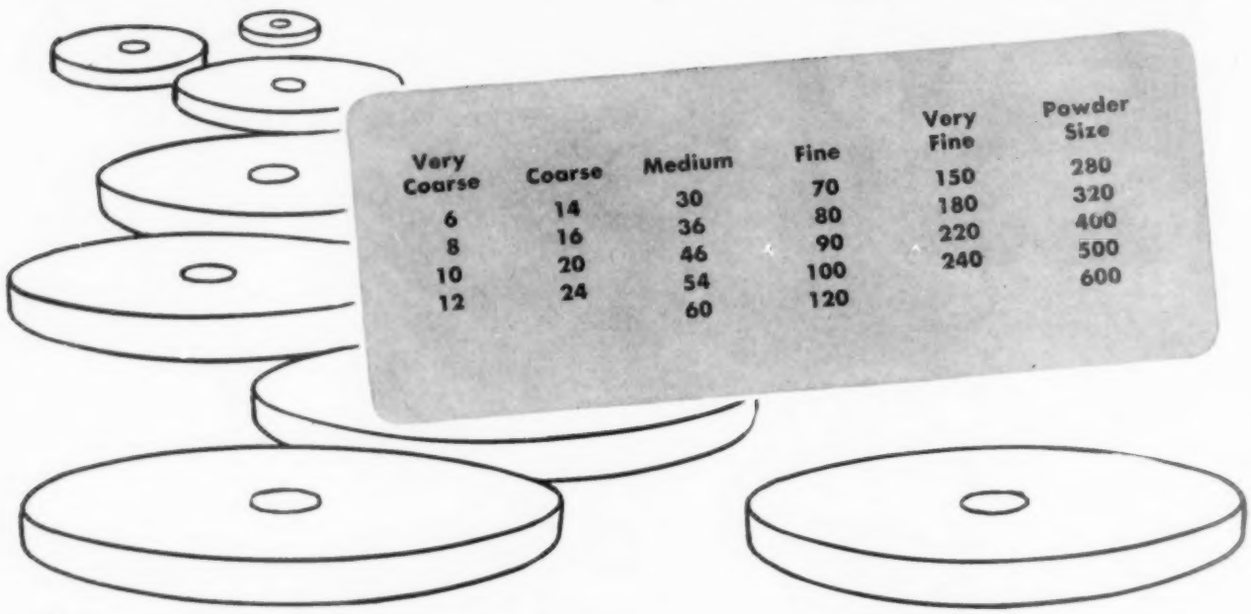
POPE MACHINERY CORPORATION

ESTABLISHED 1920

261 RIVER STREET · HAVERHILL, MASSACHUSETTS

BUILDERS OF PRECISION SPINDLES

How do you tell which grit to use?



Listed is a commercial classification of standard abrasive grit sizes. They come in a wide range... from 6 classified as very coarse to 600 classified as powder size. And, the variety is further extended by special sizes and combinations. Yet, each one is designed to do a specific job better than any of the rest.

To complicate correct choice even more, there is a long list of variable factors to consider. Among these, you'll find wheel speed, machine condition, specified tolerances, material analysis, related production schedules, and a host of others.

The correct selection hinges on the review which is given to all the controlling factors. Yet...grinding efficiency and economy depend on the right answer.

That's why the Carborundum Company has put together a practical program... a service now deemed essential by many concerns who have been successful in getting improved grinding in terms of better finishes, or at lower cost.

Your nearest contact to this service is a CARBORUNDUM representative You'll find him willing and helpful. Through a sound knowledge of abrasives and first-hand experience of their use and application in the many plants he contacts, he is able to make intelligent recommendations and suggestions. On the more uncommon problems, he can even call on our Abrasive Engineers who are more fully qualified to tackle the tough problems. And, sometimes, the answer comes from the modern laboratories at CARBORUNDUM—where scientists and technicians probe for new information on abrasives, practices and developments.

Here is a sound approach—not only to getting the right grit—but the right combination of grit, bond, grade, structure and all the other parts that make up a grinding wheel. *Plus* knowledge and experience invaluable in modern grinding methods and procedures. It's easy to use. It incurs no obligation. It makes sense. The Carborundum Company, Niagara Falls, New York.

A good rule for good grinding... **CALL IN**

CARBORUNDUM

TRADE | MARK

BONDED ABRASIVES

WHEELS
- Silicon Carbide
- Aluminum Oxide
- Diamond

Cylinder Hones
Sticks, Stones & Rubs
Specialties

COATED ABRASIVES

Paper, Cloth and Combination
Sheets, Rolls, Discs

ABRASIVE GRAINS AND COMPOUNDS

for:
Polishing
Lapping
Pressure Blasting
Finishing

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company

Read the story of how

FONDA *Lifetime-Carbide* GAGE BLOCKS

brought AT-THE-JOB ACCURACY *and a* CONTINUOUS MONEY-SAVING!

82-Piece Carbide Set • No. 82-C

FONDA
Gage Blocks
CARBIDE OR STEEL (PATENTS PENDING)

PASSED HIGHEST TESTS DEVISED BY THE NATIONAL BUREAU OF STANDARDS

Gratified business-machine manufacturers made this report after gaging over 82,340 "slots" with FONDA LIFETIME-CARBIDE gage blocks: *not one block showed the slightest wear or impairment of accuracy!*

Formerly, on a job of this scope, these manufacturers would have expended some 100 steel gage blocks for each LIFETIME-CARBIDE block now employed. They were also able to position and solder the "counters" in the castings, without affecting the corrosion- and acid-proof LIFETIME-CARBIDE blocks.

You make a lifetime investment in fine-precision accuracy when you obtain your 82-piece or 35-piece set of FONDA LIFETIME-CARBIDE Gage Blocks (Standard individual sizes from .050" to 4.000"—also special sizes). No worn gage blocks to recalibrate or replace thereafter! Costly work rejects are cut to a new low.

Industry can now profit thru *controlled accuracy* . . . from work layout and machine set-up, thru manufacturing — to finished product and inspection.

Write for the facts about LIFETIME-CARBIDE Gage Blocks

FONDA GAGE COMPANY
51 DALY STREET, STAMFORD, CONNECTICUT
Agents in all principal cities throughout the world

MANUFACTURERS OF FINE-PRECISION GAGES AND GAGE BLOCKS

What's all this about SUPERFINISH?

• If you've thought of *Superfinish* as a lavishment, then perhaps it's time to look into it a little further. You'll find enough evidence to change your notions—and perhaps give you a new competitive advantage in the form of lower costs.

No matter how fine a ground surface may appear to the eye, it has defects . . . scratches and ridges produced by the point of the turning tool . . . larger defects such as grinder feed spirals and chatter marks . . . partially loosened splinters of metal ready to come off on contact with another surface . . . soft surface metal, annealed by the heat of the grinding wheel. In practically every case, fragmented metal will be torn from the mating surfaces to mix with lubricants, causing abrasive wear and creating a larger amount of clearance.

Superfinishing prevents this by removing both grit scratches and longer pitch defects due to minute machine tool inaccuracies. It provides the surface smoothness to maintain a uniform oil film — to reduce wear — to eliminate bearing trouble and lengthen bearing life.

Superfinishing is a quick and inexpensive process. And in many cases it can reduce present manufacturing costs by eliminating other more costly processes. This is a good time to get complete information about *Superfinishing*. Write us.

GISHOLT MACHINE COMPANY
1257 East Washington Avenue • Madison 3, Wisconsin

GISHOLT

Look ahead

keep ahead

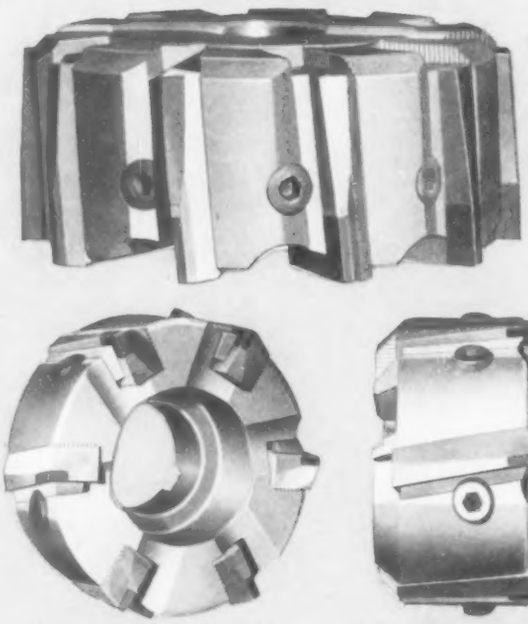
with Gisholt

This photomicrograph (25 x magnification) shows a ground surface with the familiar scratches and ridges caused by single direction stock removal. Surface roughness is 35 micro-inches (Profilometer reading).

The same piece, 30% Superfinished to 15 micro-inches. Note how ridges have been reduced. A completely Superfinished surface of 2 to 3 micro-inches will leave no defects to penetrate the oil film or abrade the mating surfaces.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

INGERSOLL CARBIDE CUTTERS *for Steel*

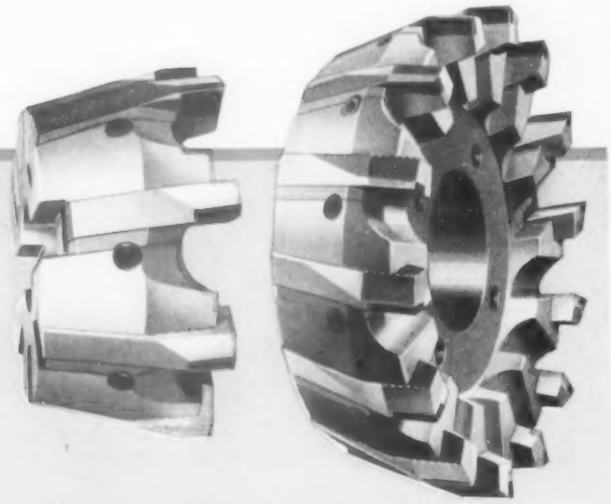


The introduction of *negative cutting angles* has made possible the use of carbide tipped blades for milling steel. Under proper operating conditions these cutters will greatly increase feed rates and improve finish and tool life.

Both medium and heavy duty series available with *inserted replaceable* carbide blades for lowest operating cost. You purchase *one* cutter housing for each application. You fill and refill this housing many times with *inserted blades* at fraction of replacement cost of new solid type cutters.

MEDIUM DUTY 3/16″ STOCK

Cutter No.	Diameter	Teeth	Price
98104X	4	6	$ 46.00
98106X	6	8	52.00
98108X	8	12	70.00
98110X	10	14	95.00
98112X	12	16	115.00



HEAVY DUTY 1/2″ STOCK

Cutter No.	Diameter	Teeth	Price
94108XX	8	8	$ 90.00
94110XX	10	10	125.00
94112XX	12	12	150.00
94114XX	14	14	175.00

Ingersoll offers many other designs of *inserted blade* milling and boring tools with carbide tipped, cast alloy, and high speed steel blades — Face mills, end mills, slotting cutters, helical slabbing mills, cylinder boring and combination boring, facing and chamfering tools.

Write for catalog giving complete details on inserted blade milling and boring tools.

THE INGERSOLL MILLING MACHINE CO., ROCKFORD, ILLINOIS

Michigan has the longest coast line of any State in the Union.

LET MICHIGAN MACHINE AND *Broach* YOUR PRODUCTION PARTS

MICHIGAN has the largest plant of its kind in the world, new and completely equipped and ready to finish machine and broach your production parts with "undivided responsibility"

MICHIGAN WILL:

- ★ **Engineer your job**
- ★ **Build your broaches, fixtures, gages**
- ★ **Broach the part for you**

or Michigan will:

- ★ **Supply the complete part with "undivided responsibility"**

NOW any manufacturer, small or large, can take full advantage of the economies of broaching.

When the above part was milled the scrap rate was 40%. When it was given to MICHIGAN for broaching, scrap was reduced to a negligible percentage and the number of pieces was greatly increased.

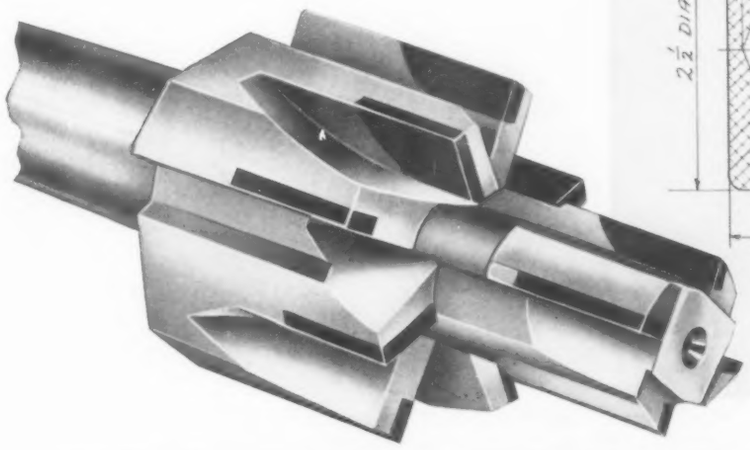
The difficulty experienced in holding the .002 tolerance in milling was overcome and held consistently in broaching.

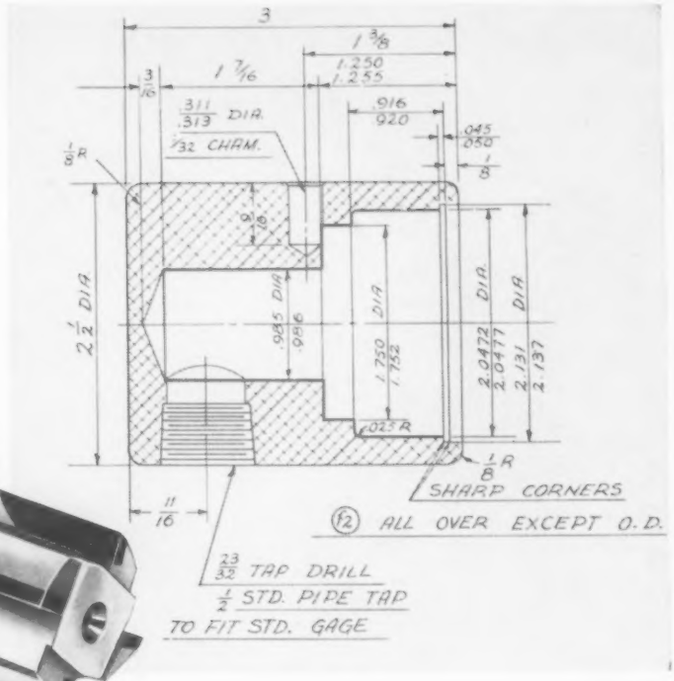
WRITE FOR OUR FOLDER. It's full of helpful information on broaching.

MICHIGAN BROACH CO.

10367 Northlawn Avenue **Detroit 4, Michigan**

Three-diameter Staples Carboloy-tipped Combination Reamer, specially designed to meet the requirements of this close tolerance operation.





Staples CARBOLOY-TIPPED CEMENTED CARBIDES SPECIAL TOOLS

SPEED THE JOB TO FINER PRECISION

Ream two or more diameters simultaneously with a Staples Carboloy-tipped Special Tool, and you save important time and costs. But, more important—you achieve an exceptional all-over precision and closer tolerances.

Staples superiority is the result of diamond lapping of Carboloy Cemented Carbide tips, copper brazed to steel for braze strength, and the fine grinding of flutes for free passage of chips. Uniform excellence of diamond ground cutting surfaces means many more pieces before regrinding.

Any job that justifies a special tool is entitled to no less than Staples Tool precision. Staples Special Tools and the line of Staples Standard Tools are widely used in American Industry . . . where stepped-up reconversion activities call for faster operations and the highest quality.

THE STAPLES TOOL COMPANY

Formerly Staples Tool & Engineering Company

CINCINNATI 25 **OHIO**

WHATEVER YOUR MACHINING PROBLEM

— however complex — Staples Special Tool engineering facilities will help you solve it.

Staples CARBOLOY-TIPPED CIRCULAR CUTTING TOOLS

REAMERS • CORE DRILLS • SPOT FACERS • COUNTERBORES • END MILLS • SHELL END MILLS • ALSO A COMPLETE LINE OF CIRCULAR SPECIAL TOOLS

SURPLUS HOBART ARC WELDERS

200, 300 AND 400 AMPERE RATINGS

Three million dollars worth of surplus Hobart Arc Welders *must* be sold between May 15th and June 15th. Most of this equipment is of the MG type but some quantity is available in gasoline driven units. Arrangements may be made to inspect the offered items. Largest inventories are located at Boston, Detroit, Cleveland, Chicago, Atlanta, Kansas City, Richmond and Philadelphia—but information on availability, condition and location may be obtained at any of the War Assets Administration Regional Offices listed below. The equipment will be sold on a "where is, as is" basis . . . used or unused . . . and priced accordingly. For full information contact the nearest office listed below or check and mail this coupon.

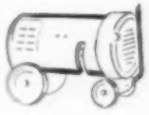
ALSO MANY OTHER TYPES OF WELDING AND FLAME CUTTING EQUIPMENT

LINCOLN

Hundreds of Lincoln Arc Welders in the popular 300-400 Ampere size are also available; some gasoline engine driven.

WESTINGHOUSE

Flexarc equipment for production or construction operations is available in smaller quantity. Also other standard makes and ratings.



RESISTANCE WELDERS

Spot Welders located in Philadelphia, Detroit, Chicago, Los Angeles, Cleveland and Kansas City; *Seam Welders* in Cleveland, Chicago, Detroit, Birmingham, Boston and Philadelphia. Also *Flash Welders.*

WELD POSITIONERS

In standard sizes and types, are located in Detroit, Boston, Chicago and New York.

FLAME CUTTERS

Save production time and money with portable or stationary, single or multiple torch flame cutting machines. All types of gas cutting equipment available for quick sale.

VETERANS OF WORLD WAR II—To help you in purchasing surplus materials, a veterans' unit has been established in each War Assets Administration Regional Office.

FREE SALE FACTS

To War Assets Administration:
Please send me information prior to your sale on the availability, condition and location of Hobart Arc Welders of the following

types:..... and ratings:.....

.....

.....

I am also interested in:—

- ☐ LINCOLN ARC WELDERS
- ☐ WESTINGHOUSE ARC WELDERS
- ☐ .....ARC WELDERS (other)
- ☐ SPOT, SEAM, FLASH WELDERS
- ☐ WELD POSITIONERS
- ☐ FLAME CUTTERS

Name.....

Firm.....

Address.....

City..... State..... 176-2

All items subject to prior sale

WAR ASSETS ADMINISTRATION

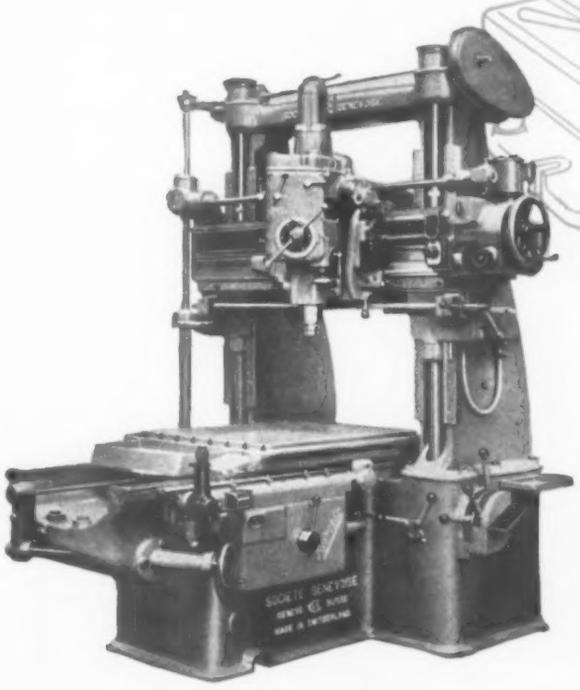
OFFICES LISTED BELOW ARE TEMPORARILY IN RECONSTRUCTION FINANCE CORPORATION AGENCIES

Offices located at: Atlanta · Birmingham · Boston · Charlotte · Chicago · Cleveland · Dallas · Denver Detroit · Helena · Houston · Jacksonville · Kansas City, Mo. · Little Rock · Los Angeles · Louisville Minneapolis · Nashville · New Orleans · New York · Oklahoma City · Omaha · Philadelphia Portland, Ore. · Richmond · St. Louis · Salt Lake City · San Antonio · San Francisco · Seattle · Spokane Cincinnati · Fort Worth (Telephone 3-5381)

LOCATING AND BORING 28 PRECISION HOLES WITHIN 1 SEC. OF ARC ON THE SIP HYDROPTIC-B

-no preliminary laying out! -no jigs or fixtures!

All 28 holes on the part shown at the right were bored at one setting on the SIP Hydroptic-B . . . without jigs and without preliminary laying out! The unique optical setting feature of the SIP Hydroptic-B Jig Boring and Milling Machine permits laying out in rectangular coordinates to within 0.0002" limits of accuracy of setting of table and spindle. And, with the circular dividing table, work dimensioned in polar coordinates can be located accurately to within *one second of arc!*



With the SIP Hydroptic-B Jig Boring and Milling Machine, work can be located, drilled, bored or milled without preliminary laying-out. More than a Jig Boring machine, the Hydroptic-B is used profitably for direct production work where highest standards of accuracy must be maintained. More than a Jig Boring machine, the Hydroptic-B is also a measuring instrument of unquestioned accuracy, and as such it can be used dependably to check its own work. Its automatic hydraulic table feeds and its wide range of spindle speeds make highest precision operations possible at production speeds. The construction of the Hydroptic-B assures the maintenance of superlative accuracy, even under heavy table loads. In addition, the optical measuring system, consisting of high precision standard scales read through protected microscopes, is free from wear and mechanical stress. Write for further details of the SIP Hydroptic-B and other SIP Jig Boring and Milling Machines.

RANGE OF TABLE SIZES

No. 2C	18" x 10¾"
No. 3K	21½" x 15"
No. 4G	27½" x 23⅝"
No. 5G	43⅜" x 32"
Hydroptic-B	39½" x 32"

We also represent in the United States other world-famous Swiss High Precision Equipment: Andre Bechler—Maag Gear Wheel Co.—Mikron—Safag—Studer—Sallaz—Schaublin—Lienhard—Billeter.

HIGH PRECISION MACHINE TOOLS AND MEASURING INSTRUMENTS

COSA CORPORATION

COSA

CHRYSLER BUILDING
New York 17, New York

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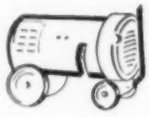

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Firm .....
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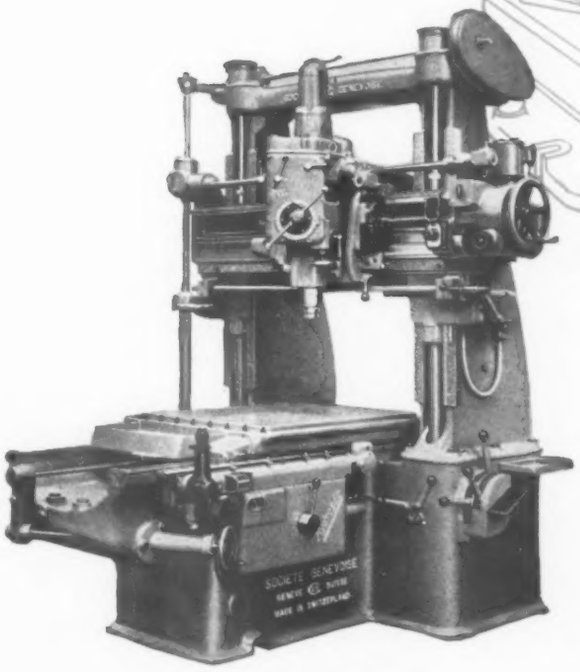

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HIGH PRECISION MACHINE TOOLS AND MEASURING INSTRUMENTS

COSA CORPORATION

COSA

CHRYSLER BUILDING
New York 17, New York

Tough Problem SOLVED WITH Atlas LATHES

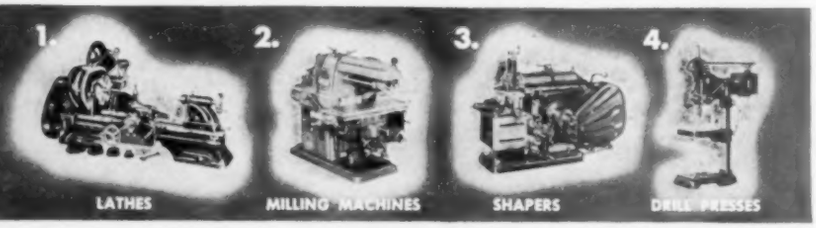
Blind machining and threading on 1½" x ½" diam. parts to .0002 precision with Atlas 10" lathes enabled the Burlake Mfg. Co., Burbank, Calif., to end the need for painstaking individually fitted assemblies of hydraulic valve cages. Results were so satisfactory Burlake reports that dollar for dollar their 4 Atlas lathes are the best investment in the plant.

Check Atlas lathe specifications against your requirements. Swing: 10½" over bed, 6⅝" over carriage, up to 36" between centers. 16 spindle speeds, 28 to 2072 RPM. Thread cutting range, 4 to 96 per inch. Power cross and longitudinal feeds. Timken bearings. Converts to hand screw machine with tailstock turrets, multi-stops, and lever-type collet chucks.

The Atlas lathe, like the rest of the Atlas 4 Tool Team, can solve many small parts production problems with important reductions in machine-hour costs. Send for latest catalog with complete specifications and operating views.

ATLAS PRESS COMPANY
514 North Pitcher Street, Kalamazoo 13D, Michigan

4 Atlas TOOL TEAM FOR SMALL-PART MACHINING



FACTS ABOUT REAMERS

MATERIAL and hole size both have much to do with selecting the best type of reamer. Shell type reamers are used for large diameter holes. For small holes and in hard, tough, or stringy materials, a solid type reamer is recommended.

Whatever your reaming job, there is a NATIONAL reamer exactly fitted to your needs. In reamers, as in other cutting tools, you get the best when you specify NATIONAL tools—the National choice.

Call Your

DISTRIBUTOR!

Leading distributors in every section of the country have stocks of National Cutting Tools. Every National distributor offers factory-trained engineers to serve you. Call your National distributor for cutting tools or any staple industrial product.

NATIONAL

NATIONAL TWIST DRILL & TOOL ROCHESTER, MICH. U.S.A.

TWIST DRILLS
REAMERS, HOBS
MILLING CUTTERS
COUNTERBORES
SPECIAL TOOLS
END MILLS

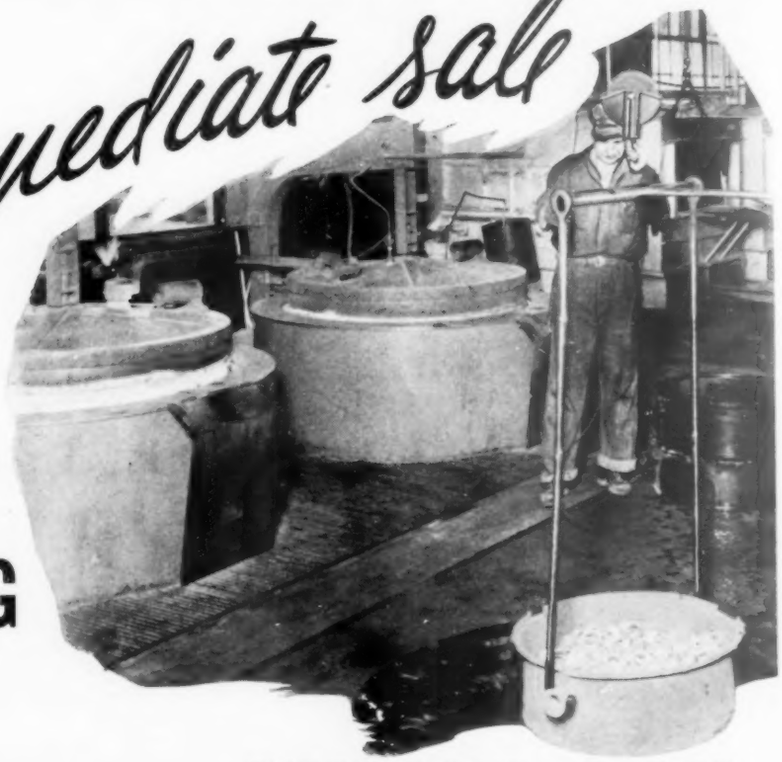
TWIST DRILL AND TOOL COMPANY

ROCHESTER, MICH., U.S.A.

Tap and Die Division — Winter Bros. Co.

Factory Branches • New York • Chicago • Detroit • Cleveland • San Francisco • Distributors in Principal Cities

for immediate sale



GOVERNMENT-OWNED
SURPLUS

HEAT TREATING FURNACES

Standard Makes · Modern Equipment · Attractively Priced

Here is real opportunity to complete plans tabled because of equipment shortages. Hundreds of surplus industrial furnaces, from melting types to induction hardeners, from simple dryers to the last word in controlled atmosphere heat treating furnaces are available now . . . in quantity . . . for immediate application to production line, tool room, or laboratory problems. Here, priced for quick sale, is exactly the equipment you have been waiting for to improve post war products or cut fabricating costs.

This equipment is now on sale at every War Assets Administration Regional Office. Check into it today.

THREE STEPS TO TAKE

1. **Accurately Determine Your Needs**—Check your operations and jot down the type of equipment you need, necessary capacities, ratings, etc. Where possible indicate the make of equipment you would prefer. This information we will need to locate for you suitable surplus equipment.

2. **Estimate the Cost You Can Afford**—Here again is a guide we will need in locating the right equipment for you among the many hundreds of available furnaces. In pricing we give consideration to such alterations as may be necessary to meet your specific problems.

CONTROLLED ATMOSPHERE HARDENERS

For precision tools and dies and applications where surfaces must be protected.

VETERANS OF WORLD WAR II: To aid you in purchasing surplus property, a veterans' unit has been established in each War Assets Administration Regional Office.

INDUCTION HARDENERS

The latest development in controlled surface hardening by high frequency induction.

3. ***FILL IN AND MAIL THIS COUPON***

To War Assets Administration: Please send me information on the following types of Surplus Heat Treating Equipment:

FUEL	INTENDED USE	TYPE OR MAKE
☐ Electrical	.....	.....
☐ Gas	.....	.....
☐ Oil	.....	.....
☐ High Frequency Induction	.....	.....

I am also interested in ☐ heating furnaces, ☐ melting furnaces, ☐ dryers, ☐ kilns.

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All in all, the Haskins Electric-Air Controlled Tapper is certain to become a most important development in modern tapping history. Send for details.

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If it's a spur or helical gear of any size up to 220" P. D. there is a Red Ring Machine on which it can be shaved.

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Shaves gears from 1" to 24" P. D.

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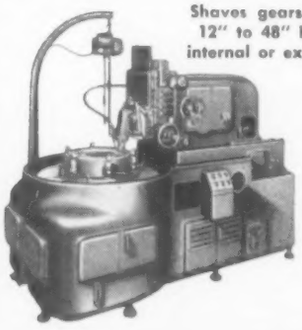
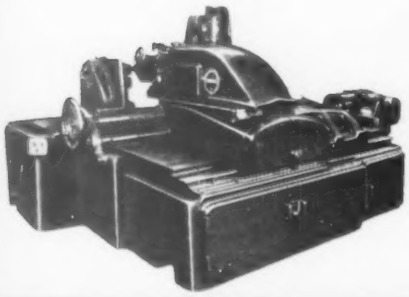
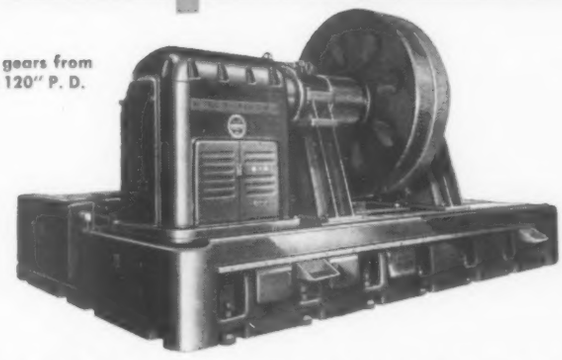


Shaves gears from 12" to 48" P. D., internal or external.

Shaves gears from 4" to 48" P. D.





Shaves gears from 24" to 120" P. D.

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Look into the

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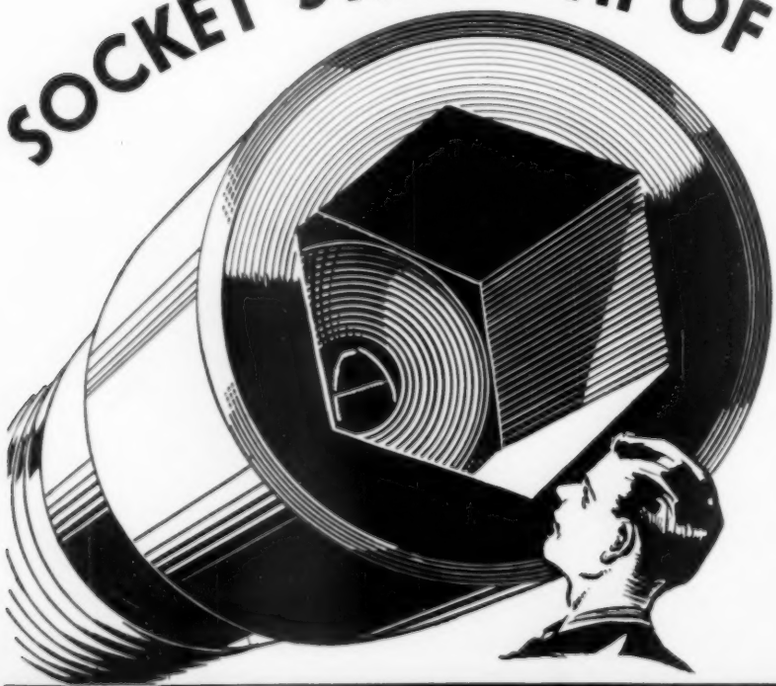

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Note the true, sharp outlines of socket walls,—so accurately shaped that the hexagon key bears evenly and equally on all surfaces. So the key snugly "bottoms" in the hole; no rocking, no wrench-play.

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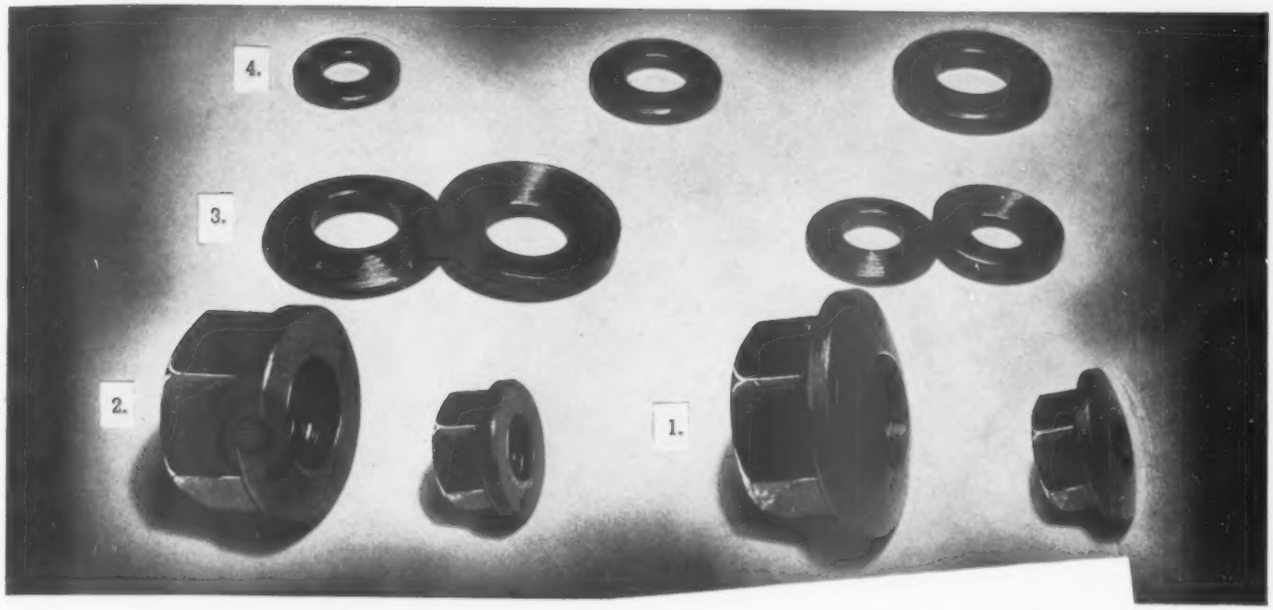

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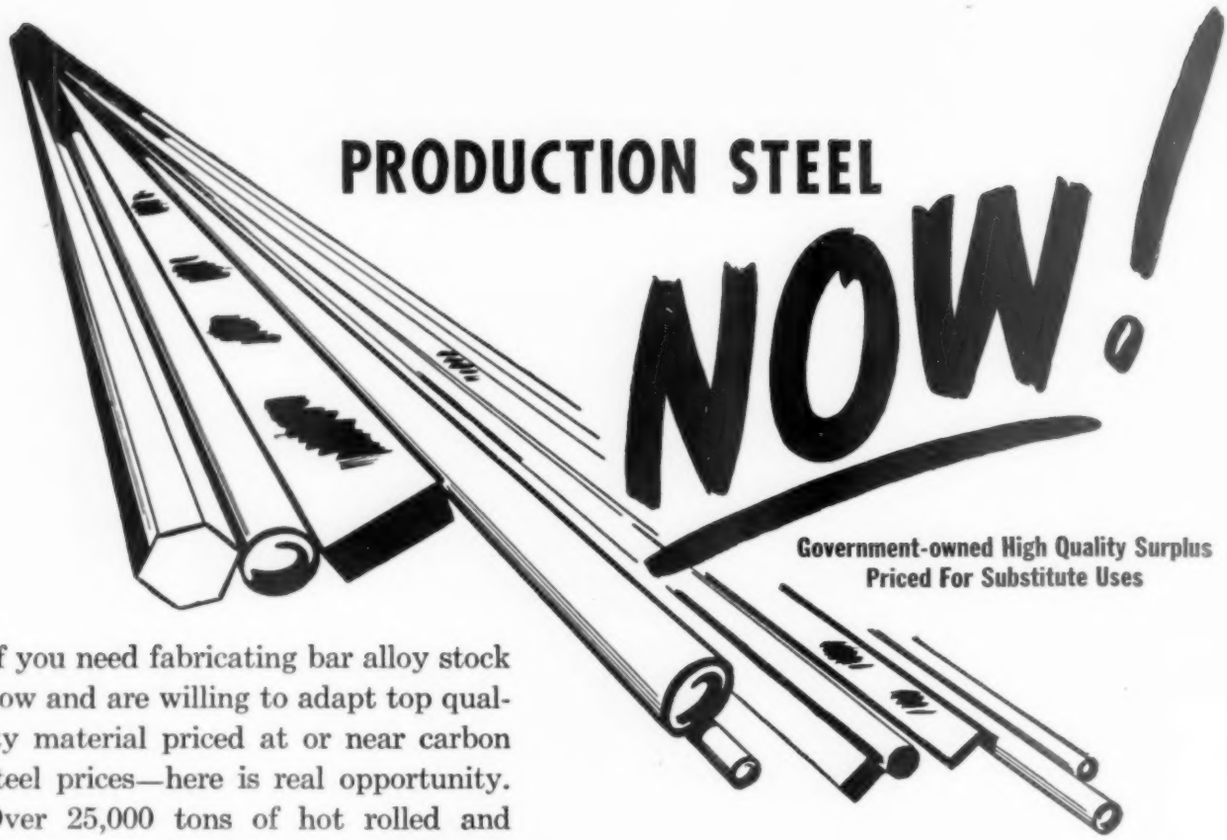

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To War Assets Administration:

Please send me information on the availability and pricing of the following:

- Carbon and Alloy Billets, Blooms, Slabs, Rods, etc. ☐
- H. R. & C. F. Alloy Sheets, Strips and Plates ☐
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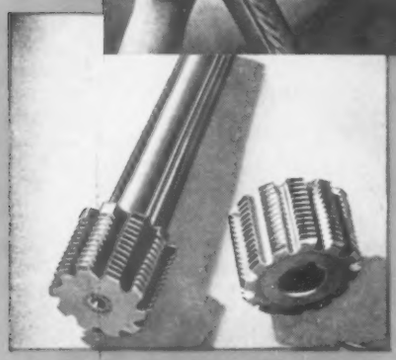
Left: Dalzen taps, in U. S., Metric, Whitworth, and Special forms are precision ground of hardened high speed steel in a complete size range. TUNGSTEN CARBIDE TAPS — EITHER SOLID OR INSERT—A SPECIALTY.



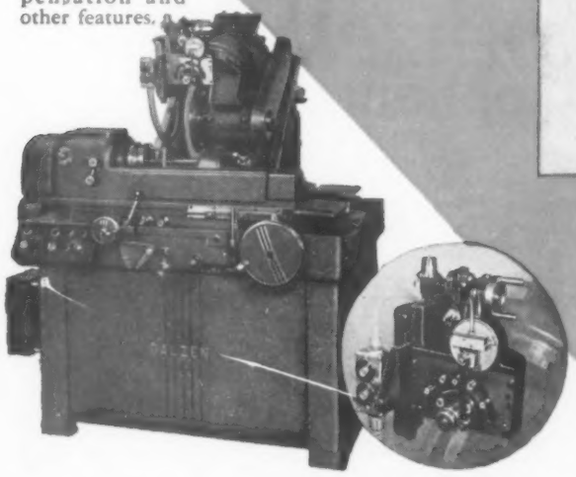
Left: High speed ground thread milling cutters, scientifically heat treated for longer cutting life.

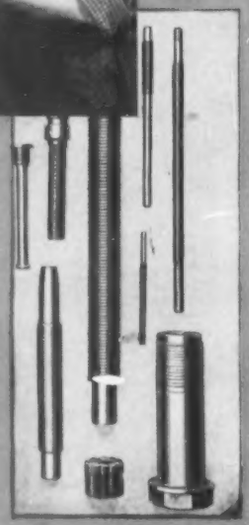
Dalzen manufactures an extensive line of precision cutting tools, parts, thread grinding and special machines — engineered for maximum efficiency and economical operation. Each is the result of years of experience on the part of designers and craftsmen. These are reasons why, all over the United States and in many foreign countries, master mechanics who have used and worked with Dalzen-made machines and tools say, "You can do it better with Dalzen." Write for details on how Dalzen can "do it better" for you.

Below: Dalzen "2-in-1" combines a dependable, accurate center lapping machine with a sturdy drill press. Saves on equipment costs, floor space.

Below: No. 5 *Electronic* Thread Grinder. Easy to operate. High production efficiency and accuracy by controlled wheel speed, motor driven dresser, automatic compensation and other features.

Right: No. 2 Thread Grinder. Compact, upright design saves floor space. Simple to operate. Low first and maintenance cost. Ideal for short or production runs.





Right: Threaded parts are ground to close tolerances exactly to your specifications. Rigid inspection standards assure a uniform fine finish. Jobs requiring rolled or cut threads are also handled.

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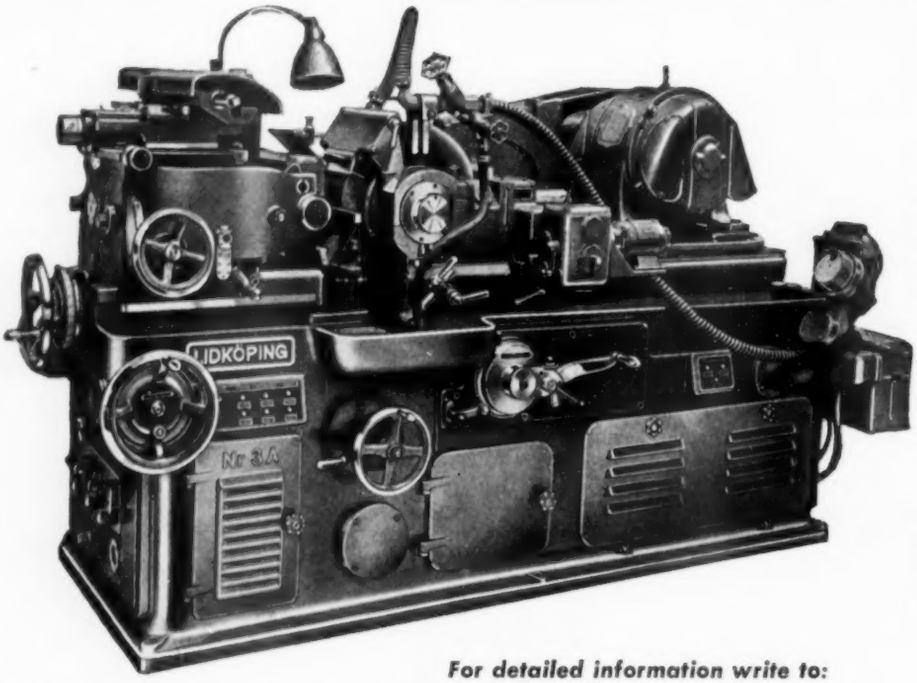

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Why Force Your Men to waste time on machine tool set-ups when CAD Standardized Appliances will convert this non-productive time into productive labor?

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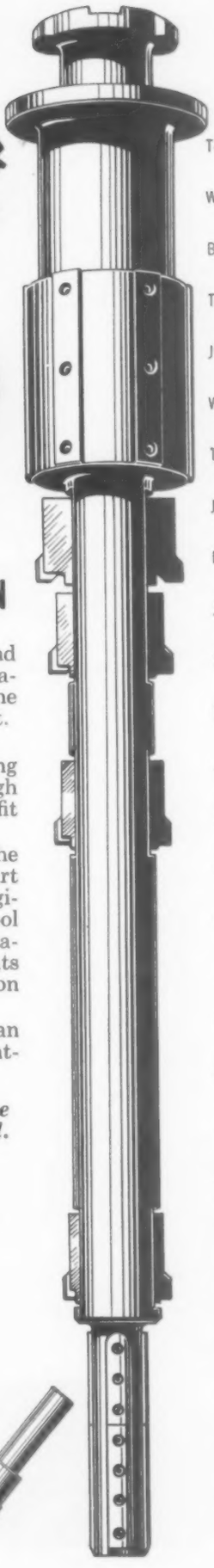

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Gairing is known by the performance of its tools and the men who sell them. The desire of our representatives to be helpful and their intimate knowledge of the field they serve will win your confidence and respect.

Their names are listed at the right.

No matter how simple or complex your tooling problem may be, Gairing engineers, working through these representatives, will gladly give you the benefit of their training and experience.

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Our comprehensive and fully illustrated catalogue will be mailed to those of you who are interested.

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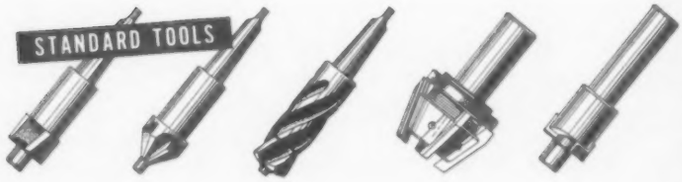

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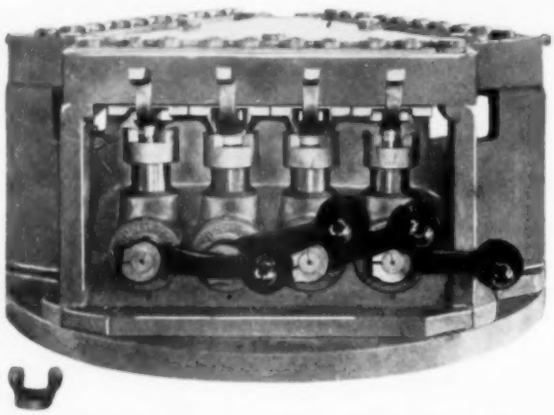

THREE STATION INDEX FIXTURE FOR DRILLING HOLES IN UNIVERSAL JOINT YOKE. PARTS ARE CLAMPED AGAINST TOP PLATE IN ORDER TO CONTROL THE DEPTH OF MACHINED HOLES.

DESIGNERS

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ALL TYPES OF HOLDING FIXTURES FOR MACHINE SHOP PRODUCTION

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TAPPING TIPS

From Woody Spencer's Notebook

A DULL TAP'S LIKE A DULL RAZOR, ONLY WORSE!

Started shavin' the other day without makin' sure I had a new, keen blade. Figured I could "get by." Well, the scratch and drag I got served me right. It didn't cost me any money but it started me thinkin.' Tryin' to "get by" with a dull tap won't hurt your face any but it sure will hurt the pocketbook. A tap that's dull runs hard, gets hot, binds, tears threads and lots of times it breaks and you lose the tap altogether. Taps are edged, cutting tools. They should be kept sharpened, not only the champfer but in the flutes too. That way you make sure of faster production, cleaner holes and smooth, uniform threads. And you sidestep all the troubles a dull tap can cause.

These Tapping Tips of Woody's are not intended as technical advice nor are they any cure-all for tapping troubles. They are just plain short cuts, hints and horse sense suggestions that Woody has picked up from the boys in the shops and wants to pass along for what they're worth. He just wants them to save a little time or make a job run smoother and quicker.

For the specific technical problems that come up with so many tapping jobs, we suggest definite engineering advice. Send the complete data on a job, material, depth, diameter, type of hole, lubricant, etc., and our engineers will be glad to make suggestions. No obligation, of course.

Woody Spencer's new Handy Tap Guide is full of information that will make tapping jobs easier and smoother. It's in convenient size for tool crib, shop or engineer's desk. And it's FREE. Write for your copy on your company letterhead.

NOTE: These Tapping Tips are appearing here as often as Woody gets time to write them up. Look for them.

THE RIGHT TAP AT THE RIGHT TIME

The Wood & Spencer Company
Cleveland 3, Ohio

INSURANCE POLICY *for production*

SUGGESTIONS FOR THE APPLICATION OF

Stuart's ThredKut

Per Cent of ThredKut Suggested	CHARACTERISTICS OF OPERATION AND MATERIAL — EACH COLUMN IS IN REFERENCE TO COLUMN ONE ONLY, NOT TO ANY OTHER. WHEN TWO RECOMMENDATIONS CONFLICT, TRY THE MEAN BETWEEN THE TWO							
	Hardness of Material	Carbon Content of Steel	Cutting Surface Speed	Depth of Cut	TROUBLE		TOOL — General	TOOL — Screw Mach.	MATERIAL
Very Low	Very Hard	Very High	Very Fast	Very Light	Rough Finish or Tool Scuffing	DECREASE THRED KUT	Milling	Sizing Box	Brass [1]Aluminum SAE X1112 SAE 1112
Low	Hard	High	Fast	Light			Boring Turning	Skiving Reamer	AMS 6440 NE 52100A NE 9442 SAE 52100 SAE 5140 SAE 3140 SAE 6140 SAE 4140 SAE 4340
Medium	Medium	Medium	Normal	Medium	INCREASE THRED KUT			Form Drill Cut-Off	NE 8630 NE 8620 SAE 4640 SAE 5120 SAE 3120 SAE 6120
High	Soft	Low	Slow	Heavy		Tool wear on Front Clearance or Short Tool Life. (Due to Wear on Front Clearance.)	Shaping Hobbing Generating		NE 9420 SAE 4130 SAE 2345 SAE 4615 SAE 1020
Straight	Very Soft	Very Low	Very Slow	Very Heavy			[1]Broaching [1]Drawing	Dies [1]Taps	AMS 6240B AMS 6250B SAE 2320 SAE 2520 Copper 18-8 Monel

[1] Sometimes with SUPERKOOL Base added. [2] With kerosene or other very light oil.

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Stuart's ThredKut Heavy Duty Cutting Oil has played an important part in solving many of industry's toughest metal working problems. Reference to the time-tested ThredKut Chart* has insured the proper application of this versatile product in many production emergencies. Alert production executives will find these aids of great help in answering troublesome metal-working problems. D. A. Stuart Oil Co., Ltd., 2727-49 So. Troy Street, Chicago 23, Illinois.

** If you haven't a copy of the Thred-Kut Chart, write us — we will gladly send you one without obligation.*

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Mac-its
FOR STRENGTH,
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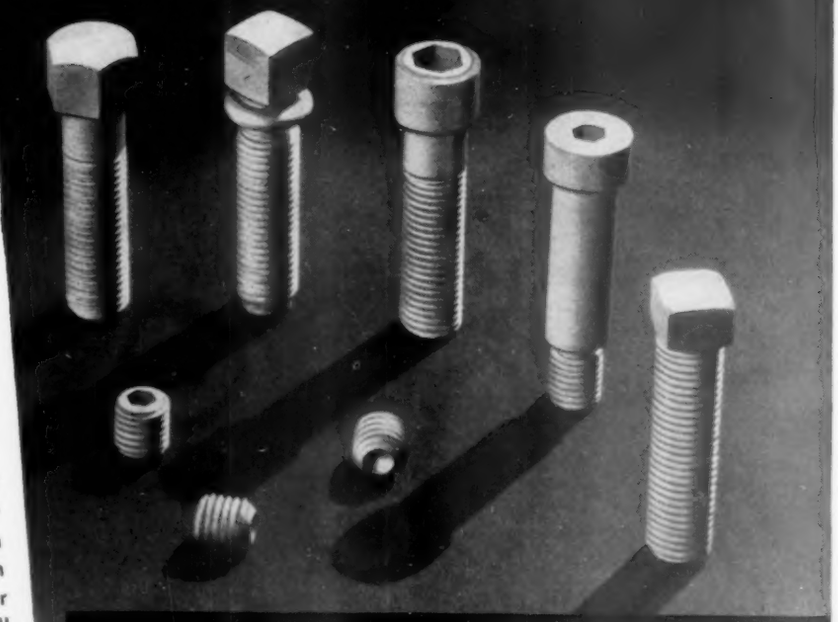

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Extra	EXTRA L	ELVANDI
Standard	RED STAR TOOL	RED STAR VANADIUM

THESE Special, Extra and Standard QUALITY Tool Steels are made for economical selection according to end use. The advice of our Sales and Metallurgical Departments is yours for the asking.

Available in billets, bars, regular or special hot rolled or cold drawn shapes, plate, sheet, circles, solid forgings, ring forgings and drill rod.

* ***One of the series of six Vasco Tool Steel Classifications covering every industrial requirement.***

VANADIUM-ALLOYS STEEL COMPANY

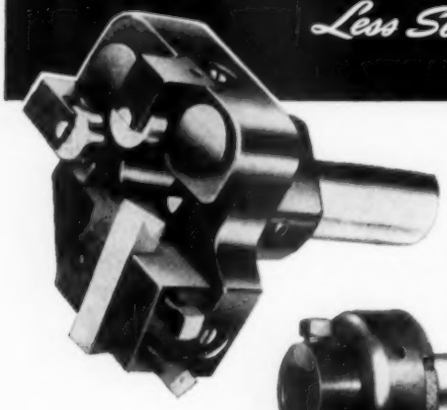
First Quality Tool Steels

Latrobe, Pennsylvania

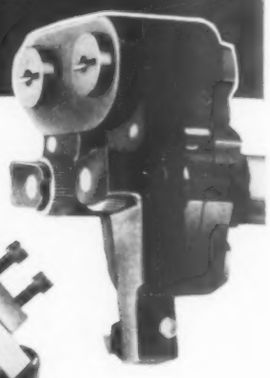
COLONIAL STEEL DIVISION . . . ANCHOR DRAWN STEEL CO.

BOYAR-SCHULTZ *Full Time* SCREW MACHINE TOOLS

Less Set-up Time Less Down Time
More Production



Much of the costly delay in setting up screw machine jobs can be avoided with Boyar-Schultz Screw Machine Tools. Designed with a full understanding of the problems confronting screw machine operators.



MODEL T Turning Tool.
A new, improved Screw Machine Tool designed with special emphasis on quick accurate set up for precision turning. Less down time is the result of speed in adjustment. Model T Screw Machine Tool is made in five sizes—Nos. 000, 00, 0, 2 and 3.

MODEL D
Floating Tool Holder.
For reaming, counterboring and drilling to close tolerances. In 8 Sizes. No. 000—to No. 6.

MODEL H
Precision Adapter.
A permanent Tool that permits the use of more than one size screw machine tool on a given size screw machine. Made in 6 Sizes.

MODEL G
Universal Tool Bit Grinding Fixture.
Tool Bits can be accurately and uniformly ground with any desired chip clearance angles. Uniformly ground tool bits save time in set-up, save tool steel and save time in grinding.

MODEL K
Knurling Tool.
A new Screw Machine Tool of outstanding design and construction making it possible to perform many of the knurling jobs formerly considered impossible with tools of other types. Speedy in operation, giving clean, accurate knurling in a minimum of time.

Write for complete details on above tools

BOYAR-SCHULTZ CORPORATION—2106 WALNUT STREET, CHICAGO 12, ILL.

ABRASIVE 3-B SURFACE GRINDER

This modern, automatic feed surface grinder has ample work ability to meet the heavy production schedules of competitive manufacturing. Its smooth action and perfect control count today where exceptional accuracy, fine finish and high production are essential. Write for Bulletin.

ABRASIVE MACHINE TOOL CO.
EAST PROVIDENCE 14, R. I.
Dealers in Principal Cities

The Government Machine Tool Surplus Lists may include ABRASIVE Machines to replace your obsolete machinery. Send us the machine serial number for any desired information; we will endeavor to provide attachments, accessories and repair parts as required.

ABRASIVE
ACCURACY BOOSTS PRODUCTION

SEE OUR CATALOG IN SWEET'S FILE

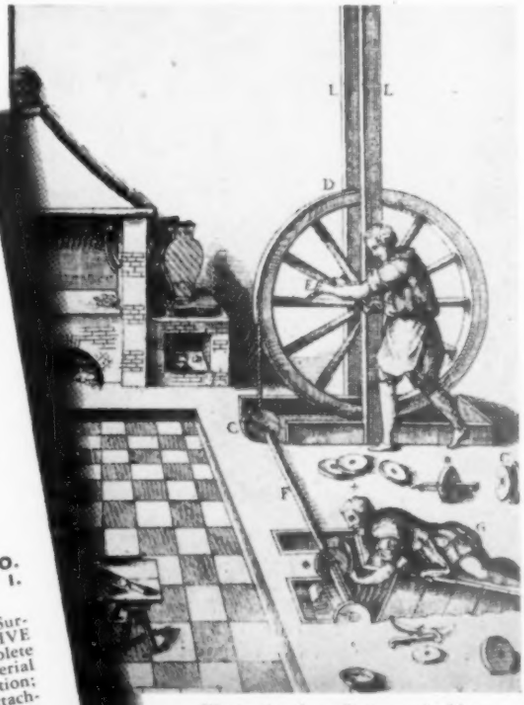


Illustration from Bettman Archive

LYING DOWN ON THE JOB THREE CENTURIES AGO

It was really a grind to produce knives and tools in this 17th century shop. The comfort of the machine operator was of no consequence and production was a creaking, time-consuming process.

OLD COINS

Are Examples of GOOD MARKING

Coins are one example of the long lasting qualities of good marking. After years of constant use they are instantly recognizable. Ancient coins have been found in almost perfect condition.

Exacting workmanship guarantees legibility, this factor is of great importance today in the marking of tools and equipment with serial numbers and trade-marks for identification and to facilitate the ordering of replacement parts and equipment.

For nearly a century Jas. H. Matthews & Co. has specialized in the design and manufacture of marking tools and dies. If you have a marking problem, we will be glad to help find a solution. *A product worth marking is worth marking well.*

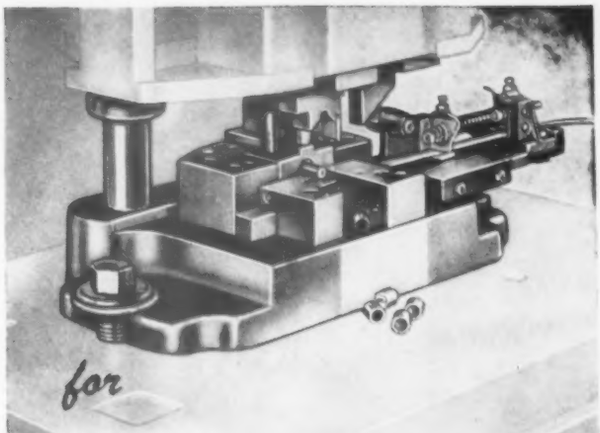
JAS. H. MATTHEWS & CO.

3923 FORBES STREET PITTSBURGH 13, PA.

BRANCH PLANTS

NEW YORK, BOSTON, CHICAGO, PHILADELPHIA, NEWARK, SYRACUSE

District Sales Offices: Cleveland, Cincinnati, Birmingham



for

PEACETIME PROFITS

With Dickerman Hitch Feeds for your punch presses, you'll get top production at rock-bottom cost. They are accurate, reliable and easily changed from one die to another. Send now for descriptive booklet.

DICKERMAN HITCH FEEDS

MANUFACTURED BY

H. E. DICKERMAN MFG. CO.

321E Albany St., Springfield 9, Mass.

TOOL SALVAGE

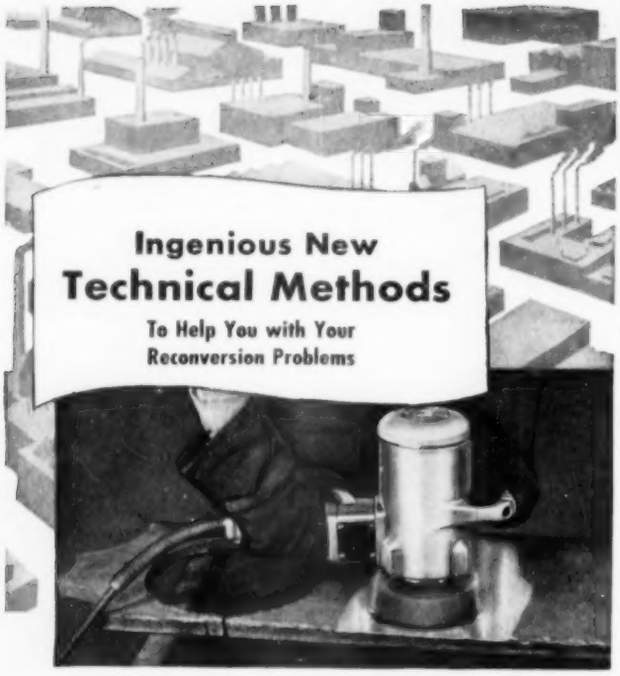
THIS TRADE-MARK IS BACKED BY 34 YEARS' EXPERIENCE IN THE BUSINESS OF RECONDITIONING METAL CUTTING TOOLS

WE ARE REPRESENTED IN YOUR TERRITORY

NATIONAL TOOL SALVAGE CO.

6511 EPWORTH BLVD.

DETROIT 10, MICH.

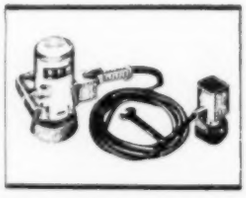


New Portable Grinder Lasts Longer ... Increases Production

The Portable Gaston Grinder is designed for the grinding and sanding of metal—also, with wire brushes, for paint and rust removal. Because it is powered by a 3-phase motor, without brushes, commutators or gears, the Gaston will give long service.

The Gaston Grinder starts at full speed. Its speed remains constant regardless of extra pressure by the operator. This controlled speed under heavy load, eliminates glazing of the grinding wheel; produces a better ground surface.

Three sizes of dust-tight Gaston Grinders are available. Furnished in either "cup-wheel" or "edge-wheel" type, as desired.



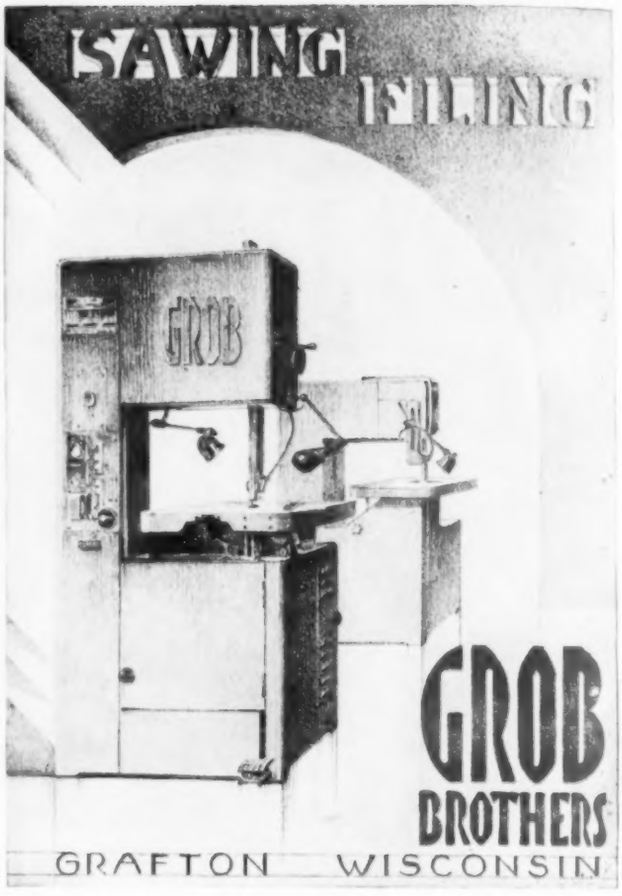
The Portable Gaston Grinder

In a dusty work atmosphere, that causes throat irritation and dryness, chewing Wrigley's Spearmint Gum helps keep workers' mouths moist and fresh—thereby reducing work interruptions—and "time out" to the drinking fountain.

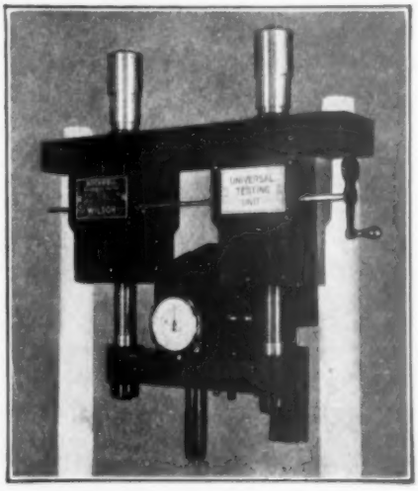
Workers can stay at their machine, while chewing Wrigley's Spearmint—even when their hands are busy. There is no lost time. And the pleasant chewing helps keep them alert and wide-awake. One Connecticut manufacturer with a dust problem reports group production up about 3% over normal, when workers were given chewing gum. Other plants and factories everywhere, claim stepped-up efficiency when chewing gum is made available to all.

You can get complete information from William H. Houland, 2533 East 73rd Street, Chicago 49, Illinois

AA-69



"ROCKWELL" HARDNESS TESTER



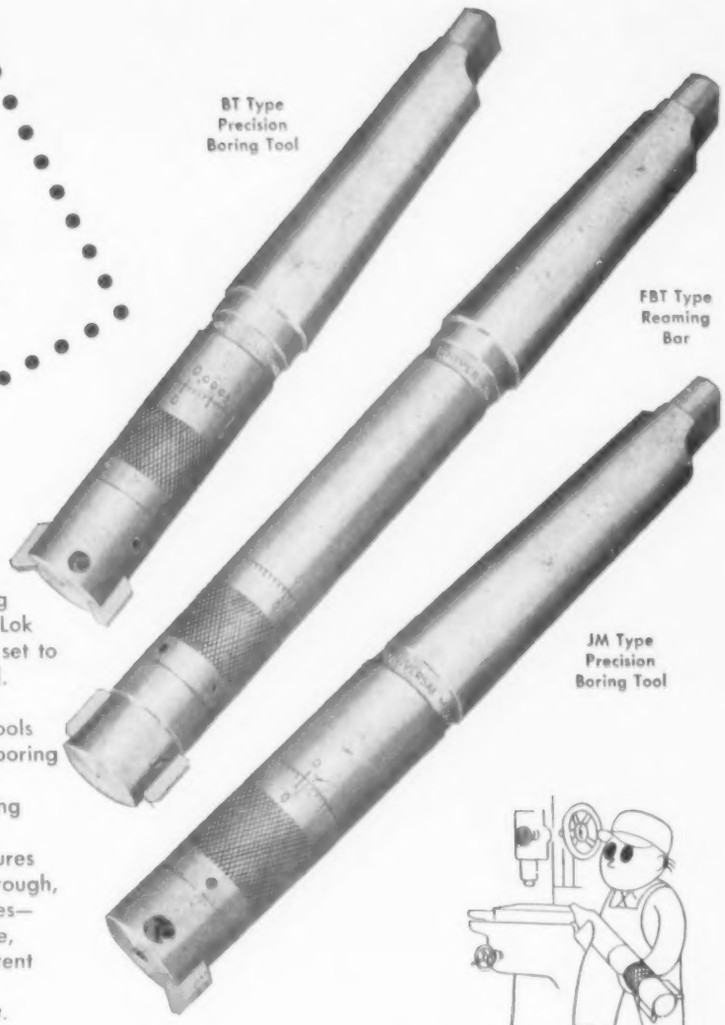
NOW there is a way with our new Universal Testing Unit, that you may use "ROCKWELL" and "ROCKWELL Superficial" Hardness Testers on the largest or heaviest pieces you desire to test. You build your supporting frame. The U.T.U. comprises moving and all testing mechanism. Ghost pillars shown are merely our Standardizing frame.

ACCO
An Associate Company of American Chain & Cable

WILSON
MECHANICAL INSTRUMENT CO. INC.
373 Concord Avenue, New York 54

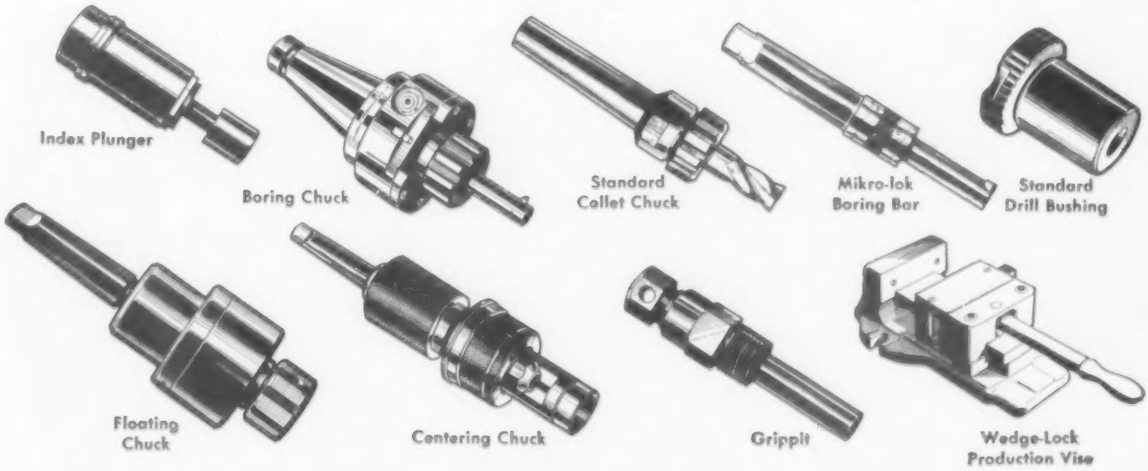
UNIVERSAL MIKRO-LOK BORING BARS

SPEED BORING OPERATIONS



No slow, trial-and-error methods of setting cutting tools with the Universal Mikro-Lok Boring Bar! Tools are quickly and easily set to within .0005" accuracy by micrometer dial. Will repeat size within .0002". Exclusive Mikro-Lok arrangement securely grips tools at extreme end of bar for accurately boring diameters as small as ½". Precision manufacturing and assembling of adjusting nut and wedge holds dial backlash to minimum: heat treating of all parts assures maximum resistance to wear. For light-rough, semi-finish, and finish boring of all types—including boring to bottom of blind hole, boring to a shoulder, or taking intermittent cuts—make Universal Mikro-Lok Boring Bars standard equipment in your plant. Write for complete information.

UNIVERSAL TOOLS THAT WILL INCREASE PRODUCTION AND EFFICIENCY IN YOUR PLANT.



UNIVERSAL ENGINEERING CO. **FRANKENMUTH, MICHIGAN**

BOYAR-SCHULTZ SURFACE GRINDER
MODEL 618

A machine tool designed to give the fine finish and high degree of accuracy necessary in the finest gage grinding and tool and die making. It is built with a sturdy ruggedness that maintains that fine accuracy for a long period of time . . . much longer than most similar tools are expected to last.

Such long-lasting precision performance gives the inevitable result of greater economy.

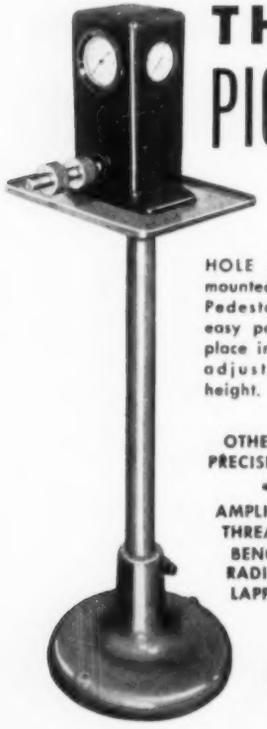
Protect Your Tool Dollar with the Finest!

BOYAR-SCHULTZ CORPORATION
2104 Walnut Street — Chicago 12, Illinois

THE AMERICAN HOLE CHECKER

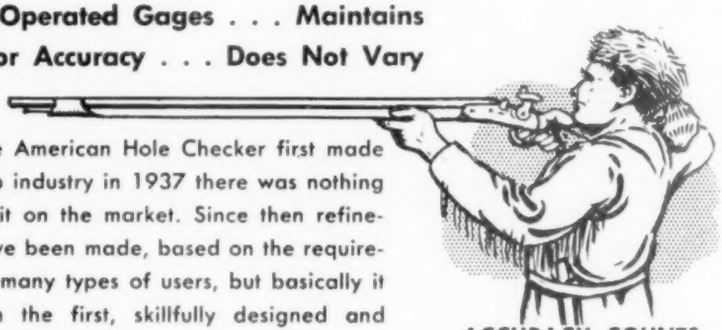
PIONEER

of Air-Operated Gages . . . Maintains Lead for Accuracy . . . Does Not Vary



HOLE CHECKER UNIT mounted on Space-Saver Pedestal accessory for easy positioning at any place in shop and quick adjustment to right height.

OTHER AMERICAN PRECISION PRODUCTS
• • •
AMPLIFYING GAGES
THREAD CHECKERS
BENCH CENTERS
RADIUS DRESSERS
LAPPING PLATES



ACCURACY COUNTS

When the American Hole Checker first made its bow to industry in 1937 there was nothing else like it on the market. Since then refinements have been made, based on the requirements of many types of users, but basically it was from the first, skillfully designed and soundly engineered.

So the air-operated unit you get today is time-tried and dependable for I. D. checking. With an O. D. accessory unit, it may also be used for outside diameter checking.

The Hole Checker is the ideal gage for both production and inspection. It is quickly set up—easily read—and it does not vary. Accuracy to .0001". The standard Hole Checker unit is used with one special sizing plug for each hole checked. Unit is set for gaging parts by means of two master ring gages.

Send parts prints for quotation. Write for new catalog and prices.

The AMERICAN GAGE & MFG. CO.
125 Bayard St. DAYTON 1, OHIO

ENGINEERS—PRODUCTION—INSPECTION MEN!

BOOST PRODUCTION AND PRODUCT QUALITY—
15 DAY SHIPMENT OF URGENT ORDERS

Curtiss-Wright Corporation ranks our product with *their* best tools. Cleveland Graphite Bronze Company, leading bearing manufacturer, states new high accuracy reached, plus substantial production boosts.

WITH

Young Roller Clutch Precision Mandrels

No more "C" washers, wrenches, drawbars, no more arcs or tapers before or after expansion grip—concentricity in low 10,000ths — production or inspection.

Assured parallelism of sleeve surface to center line—absolutely no variation in repeated mounting of parts. Uniform full-work-length friction-locking gives complete control and contact of entire bore surface area —Absolutely no variation in repeated mounting of parts—no tapers—Slip part on mandrel with slight counter-clockwise motion, that's all—it's ready—Self-contained, self-expansion, self-locking, self-contraction. Instant unloading, no jamming, no adjusting —Interchangeable sleeves—you do not obsolete Young Mandrels.—Built to your bore tolerance high limit, with automatic contraction to low limit—Any mounting—Any machine operation—For bore diameters .718 to 5.5—Reduces tool costs, extra equipment investment, operating costs, maintenance, down time, scrap, salvage.

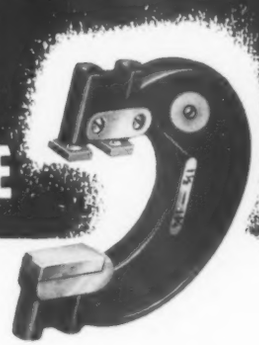
Patent Pending

Quotations Definitely Moderate

Good delivery Schedules

YOUNG ARBOR CO., 3257 Bradford Rd.
CLEVELAND HEIGHTS 18, OHIO

PHOENIX
Adjustable Limit
SNAP GAGE



A Gage with Locking Cam which will stay set—

Send for folder and discounts. Will send sample for inspection if desired.

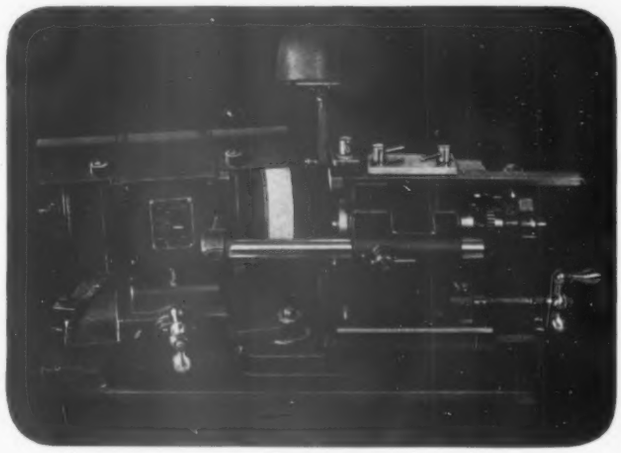
ATTRACTIVE PRICES
BUY DIRECT FROM US

PHOENIX GAGE CO. PHOENIX, N.Y.

EDWARD **Blake** COMPANY

634 COMMONWEALTH AVE., NEWTON CENTRE 59, MASS.

So Many More Holes per Tap in So Few Minutes on the BLAKE TAP GRINDER



MULTIPLYING TAP LIFE—*ten and more times*—is the *specialty* of the Blake Tap Grinder. It provides a rapid, low-cost method for accurate sharpening of taps on the chamfer.

The BLAKE removes the dull material from the chamfer *and—in the same operation*—grinds the necessary clearance behind the *new* and *sharp* cutting edges.

Taps kept sharp on the Blake maintain size and thread form over a long useful life. Many users report bonuses of thousands of extra holes from every tap kept sharp on the Blake Tap Grinder.

With the BLAKE you can sharpen both right- and left-hand taps—*without* special gearing or fixtures. You can sharpen taps with 2, 3, 4, 5, 6, 8 or 10 flutes. Capacity is from No. 0 to 2 inches. We invite your investigation of this *modern* method of prolonging tap life.

No machine is better than the cutting edge of the tool it uses.

Please send me Bulletin No. 544 which describes the Blake Tap Grinder in detail. T.E.

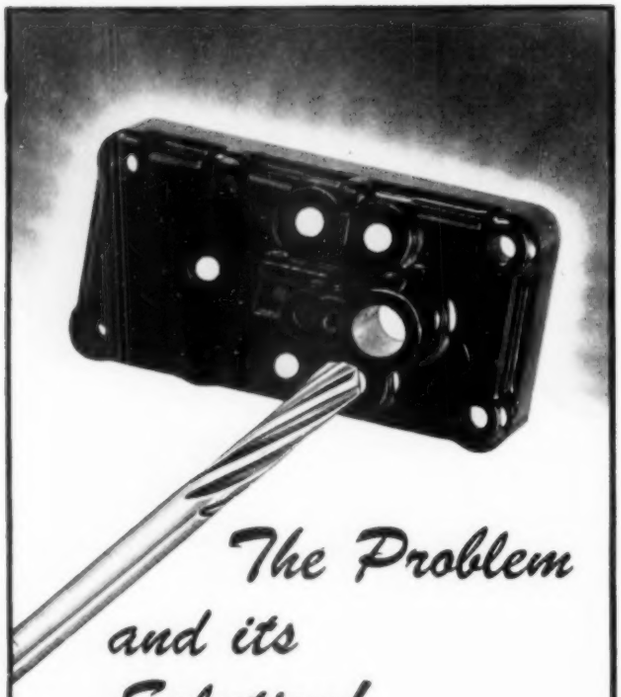
NAME_____ TITLE_____

COMPANY_____

STREET_____

CITY_____ STATE_____

BLAKE TAP GRINDERS—FILTAIRE PORTABLE DUST COLLECTORS—AMERICAN TOOL HOLDERS—BLACK DIAMOND PRECISION DRILL GRINDERS—WALTHAM CUTTER SHARPENERS—HAGER CARBIDE TOOL GRINDERS



The Problem and its Solution!

Wilcolator* had a problem! Plastic casings for its heat controls were breaking at a discouraging rate when ordinary reamers were used to clean and true up the little brass insert moulded into them.

Then Wilcolator called on L & I for special reamers for this job. Here are their exact words as to the result. "On the very first run of 1200 pieces — and for the first time since we have been making them — we have had not a single loss through breakage, and not a single reject for failure to gauge properly even though the total tolerance is only 0.001"."

The same engineering skill that designed and built these special reamers for Wilcolator is exemplified in the regular line of L & I Standards. User after user is daily discovering that the L & I method of grinding after the solid bar is hardened produces a keener, faster-cutting, longer-lived edge, capable of more cuts and greater precision — higher production at lower cost.

Put L & I Reamers to work on your problems. They're available with straight or spiral flutes, in chucking, hand, rose, stub screw machine and taper pin types, in sizes from 1/16" to 5/16" and specials to order.

LAVALLEE & IDE, INC.
CHICOPEE, MASSACHUSETTS

*The Wilcolator Company
Elizabeth, N. J.

L&I GROUND FLUTE REAMERS

ARMSTRONG

ARMALOY
Cast Alloy
Bits and Blades

for use in
ARMSTRONG
CA TOOL HOLDERS

ARMALOY is an improved "cast alloy" cutting steel with a hardness between high speed steel and the sintered carbides. It is recommended for both roughing and finishing operations on steel, malleable and cast irons, non-ferrous metals, rubber and plastics where sufficient speed can be obtained to take advantage of its high cutting efficiency.

ARMALOY Bits and Blades come surface ground to exact size to fit corresponding ARMSTRONG CA TOOL HOLDERS. They are sold singly or in tool holder and cutter sets by industrial distributors.

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
357 N. Francisco Ave. Chicago 12, U.S.A.

Eastern Whse. and Sales: 199 Lafayette St., New York 12, N. Y. Pacific Coast Whse and Sales Office: 1275 Mission St., San Francisco 3, Cal.

Help Increase Production use the

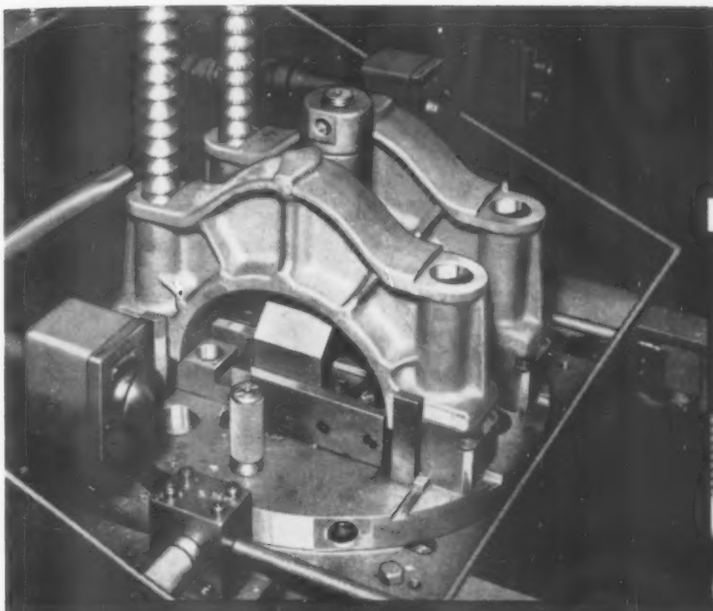
SWEDISH INTERNAL INDICATOR GAGE

It can be set to any required size direct from Johansson Gage blocks or master ring.

This light, easily handled instrument when used by machine operators, or on final inspection, serves to increase production, reduce scrap and assure a more uniform product. It is a reliable, precision indicator designed for rapid, convenient and accurate measurement of internal diameters. The scale range is: Plus or minus 0.001" graduated to 0.0001" and minus 0.020" graduated to 0.001".

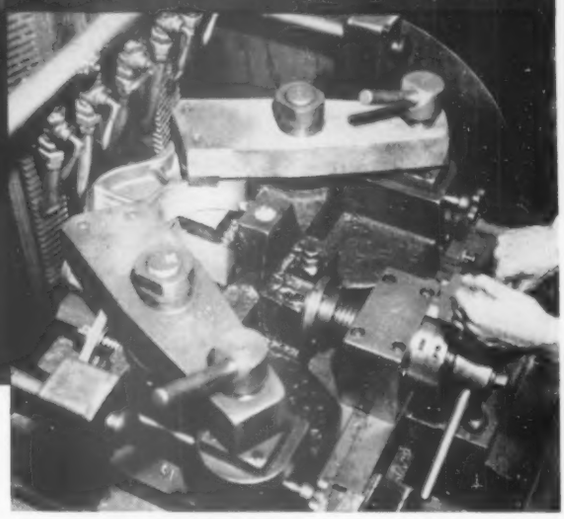
Write for Circular-TE

SWEDISH GAGE CO., OF AMERICA
8900 ALPINE AVE., DETROIT 4, MICH.



Finish broaching of four bolt holes (1-9/16" dia.) in two forged steel caps is done in less than a minute by Oilgear Vertical Pulldown Broaching . . . which proved faster and more accurate and eliminated defect-producing scratch marks.

3/16" of stock broached from two bolt bosses simultaneously on Oilgear Vertical Broaching machine which also broaches 1¼" stock from two lock-fit and joint-face surfaces measuring 2¾ x 2¾".



In removing metal and finishing surfaces such as these

. . . Oilgear broaching reduced operations and saved $3872.00 a month

How much can Oilgear Save for YOU?

The parts pictured in the two photographs shown above are main bearing cap forgings used in a well-known Diesel engine. Formerly, these forgings had to be milled . . . planed . . . hand-scraped . . . drilled . . . reamed . . . and bored before they were ready for assembly. Now, with Oilgear Broaching, the task is much simpler. Two bolt bosses, two bolt holes, lock-fits and joint-faces are rough and finished broached. That is all.

The consequences are amazing: More than $60 saved in direct costs for each set of bearing caps, an average of $3872 a month; an abrupt production jump; a far lower investment in equipment; lower tool cost per cap; closer machining tolerances for faster, easier assembly; better finish; less maintenance; less part distortion; less floor space; less power consumed. Oilgear Broaching may well do as much for you.

The time has come for every industrial executive again to take costs seriously. The time has come for every industrial executive to investigate Oilgear Fluid Power Broaching for the tremendous impact it can have on costs of every sort. Get the facts *NOW*. THE OILGEAR COMPANY, 1308 W. Bruce St., Milwaukee 4, Wisconsin.

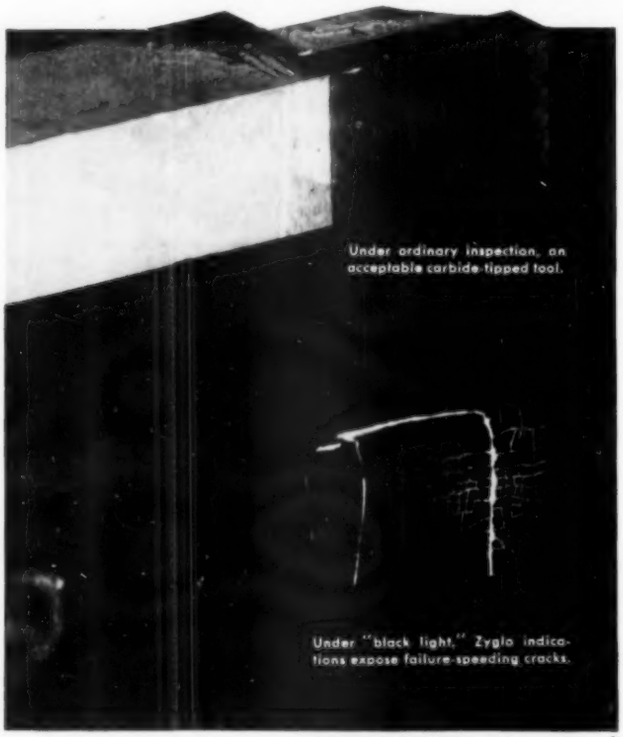
OILGEAR BROACHING MACHINES

Oilgear manufactures a complete line of broaching machines . . . horizontal and vertical for every internal and external broaching operation. The superiority of Oilgear Broaching Machines results essentially from the recognized superiority of Oilgear Fluid Power. High broaching and return speeds are independently adjustable. Simple push-button controls provide manual, semi-automatic or full automatic operation. Machine, power system and tools are fully protected against overload. Power is consumed in proportion to speed and load only.

Oilgear Fluid Power

Fault-Finding

Cuts Tool Costs


Under ordinary inspection, an acceptable carbide-tipped tool.
Under "black light," Zyglo indications expose failure-speeding cracks.

INSPECTION WITH ZYGLO*

INSURES FLAW-FREE TOOLS

By its ability to quickly find faults in tools, and expose them in sharp fluorescent patterns, Zyglo is rapidly obsoleting ordinary tool inspection procedures.

Zyglo trims tool costs for their producers, by disclosing defects in the early stages of manufacture. It cuts costs for users of tools, by locating flaws *before* they cause costly product spoilage. And inspection with Zyglo is applicable to all types of tools, including high-speed, stellite and carbide . . . is the easier, non-destructive way to insure highest tool quality.

Write for full details on speedy, economical Zyglo today.

MAGNAFLUX CORPORATION

*ZYGLO—Reg. U. S. Pat. Off. Trade Mark of Magnaflux Corporation applied to its equipment and materials for fluorescent penetrant inspection.

MAGNAFLUX CORPORATION
5914 Northwest Highway
Chicago 31, Illinois
New York Detroit Dallas Los Angeles Cleveland

Make TAPS AND REAMERS LAST LONGER!

Types to fit any machine used for tapping or reaming

Before discarding taps and reamers as worn out, try them in a Ziegler Floating Holder and you will find that many of them are still good for a long period of service.

Taps and reamers are often blamed for causing oversize or bell-mouthed holes when the only thing wrong is misalignment of the work with the spindle. By automatically correcting alignment inaccuracies up to 1/32" radius, or 1/16" diameter, the Ziegler Floating Holder enables the tool to perform perfect work even though the set-up may be faulty. Don't make the mistake of scrapping taps and reamers too hastily. Before calling them worn out, try them in a Ziegler Holder. It will save you tool expense.

W. M. ZIEGLER TOOL CO.
1930 Twelfth Street Detroit 16, Mich.

WRITE FOR CATALOG

Ziegler ROLLER DRIVE FLOATING HOLDER for Taps and Reamers...

ARE YOU OVERLOOKING Thread Rolling?

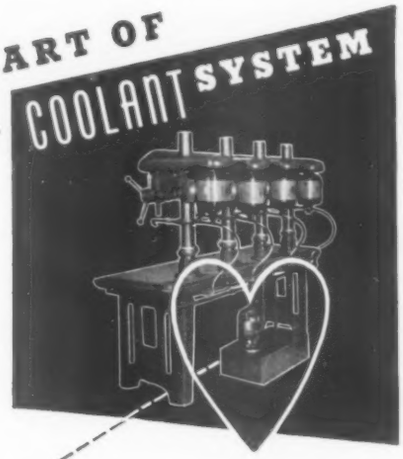
The process that excels in 6 ways!

- √ Lower Cost
- √ Greater Accuracy
- √ Greater Uniformity
- √ Wider Versatility
- √ Smoother Finish
- √ Increased Strength

Submit your threading problems to our engineers. Write for folder "Thread Rolling In Action."

ROLLED THREAD DIE COMPANY
Thread Rolling Dies and Machines
237 Chandler St., Worcester 2, Mass.

THE HEART OF YOUR COOLANT SYSTEM



RUTHMAN
GUSHER
COOLANT PUMPS

Gusher Coolant Pumps assure you of:
ECONOMY — Uses less power when throttled, cuts operating costs.
LONG LIFE—Simple design, precision construction assures long life.
EFFICIENCY — Split second control of coolants from a trickle to full volume.

Model TL-7320

THE RUTHMAN MACHINERY CO.
1810 READING ROAD
CINCINNATI 2, OHIO
The "GUSHER"—A Modern Pump For Modern Machine Tools

Now!
DRY-CYANIDING
BETTER HARDENING-BETTER RESULTS

Solves many problems in case-hardening light sections made from mild steels

1. Harder case
2. Tougher core
3. Far less warpage
4. Low price per lb.
5. Quick delivery

SEND FOR

PERFECTION
TOOL & METAL HEAT TREATING CO.
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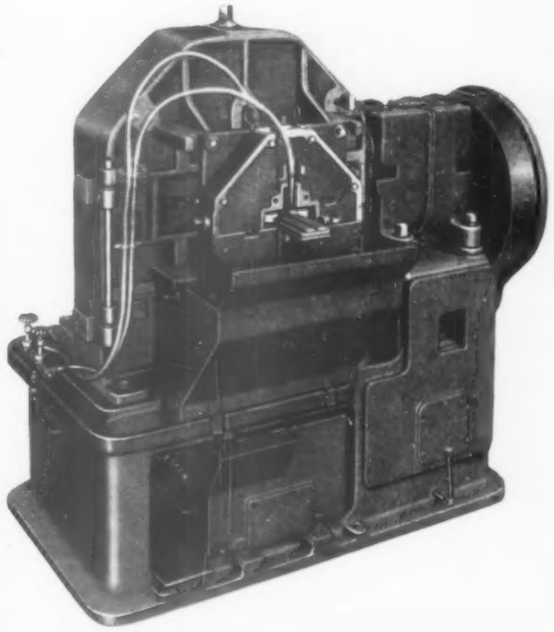

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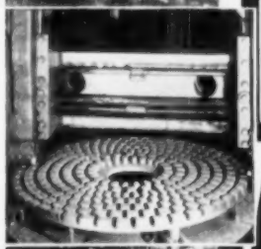
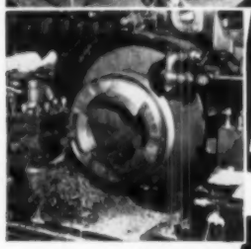
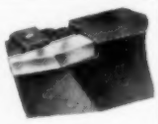
Kennametal Grade K6 is one of the most useful and needed recent developments in tool materials for machining cast iron and non-ferrous metals. It is an improved tungsten carbide having unusual strength in combination with exceptional abrasion-resistance and high hardness. The four performance studies outlined below are typical of scores of comparative service results that clearly show the superior properties of K6 for interrupted and continuous cutting on cast iron.





MULTIPLIES OUTPUT, ON FACING OPERATION, ON SANDY IRON CASTING



Replacing another make of carbide with a Style 11HD Tool having a clamped-on, advanceable K6 tip, made possible tripling the feed, doubling the cutting speed, and facing 6 times as many pieces per regrind. Operation—facing sandy iron castings. Feed—.036". Depth of cut—1/8" to 3/16". SFM-150 at start, 320 after tool entered cut.

REMOVES TONS OF METAL FROM CHILLED CAST IRON PARTS, AT TOOL COST OF 74 CENTS PER TON

Style 12 Tool with K6 tip turns 1⅛ lineal miles between grinds! Other makes of carbide failed at all speeds and feeds. After 10 regrinds K6 tip is used on lighter jobs. Operation—turning cast iron piston trunks, 21⅛" diameter, having six 3" or 4" ports (interrupted cut). Chilled around port holes. Very sandy surface. Feed—.09375". Depth of cut—⅛". SFM-120.

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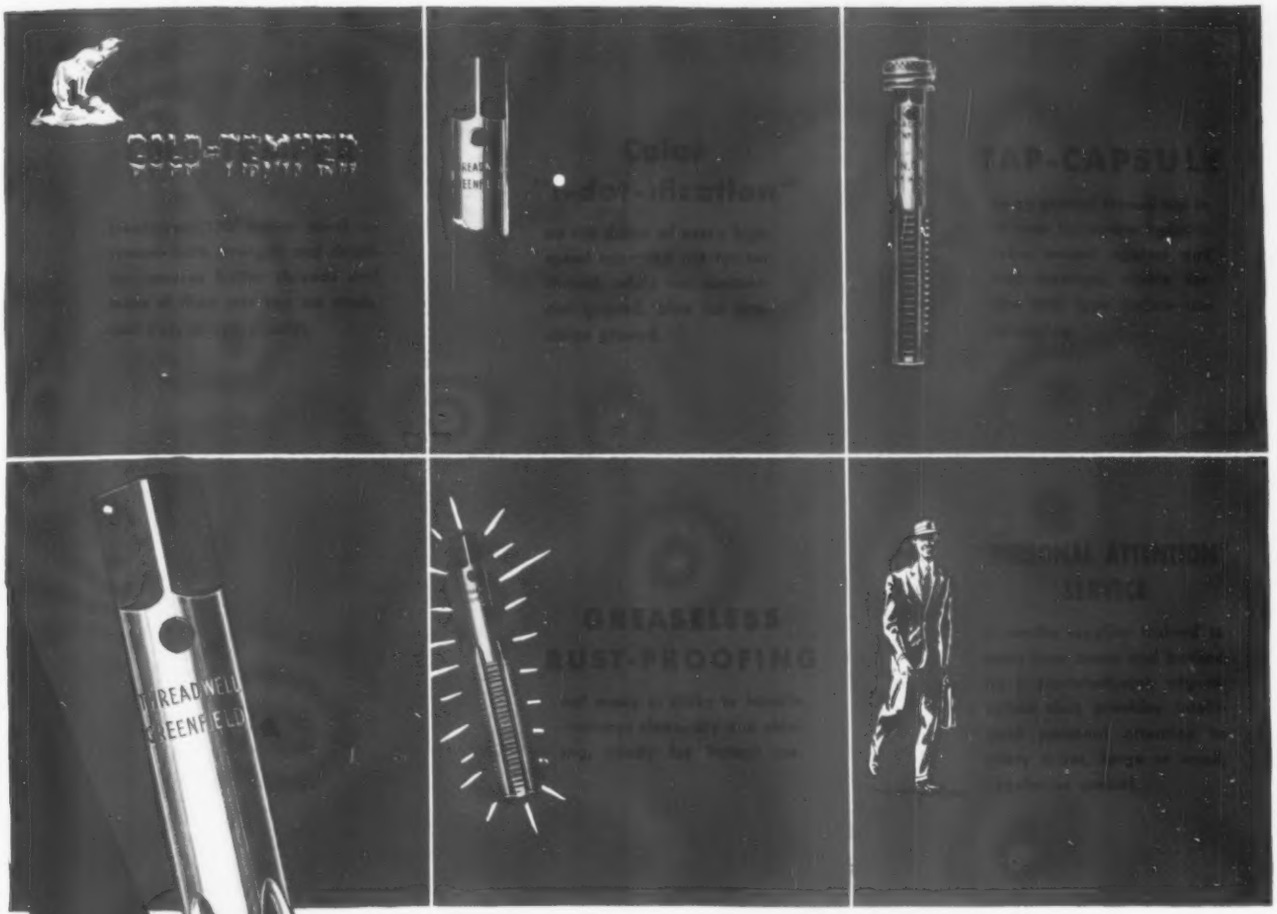

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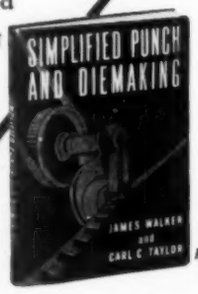

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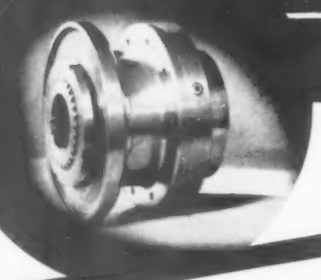

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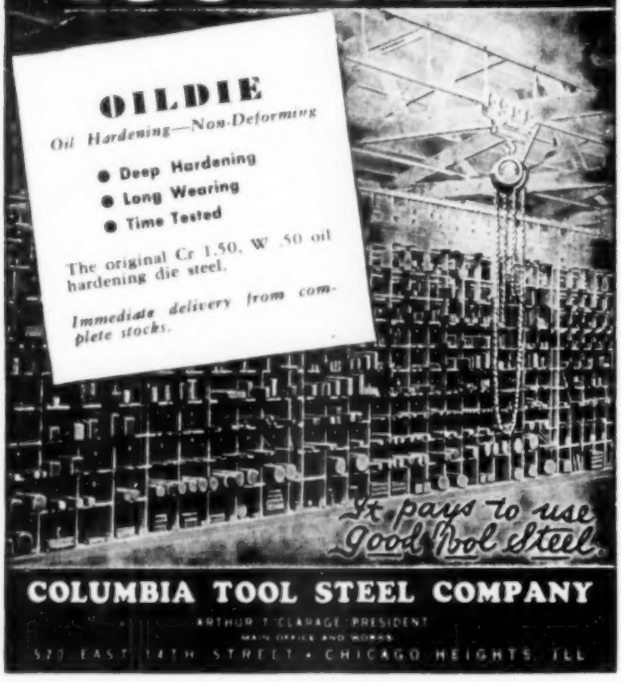
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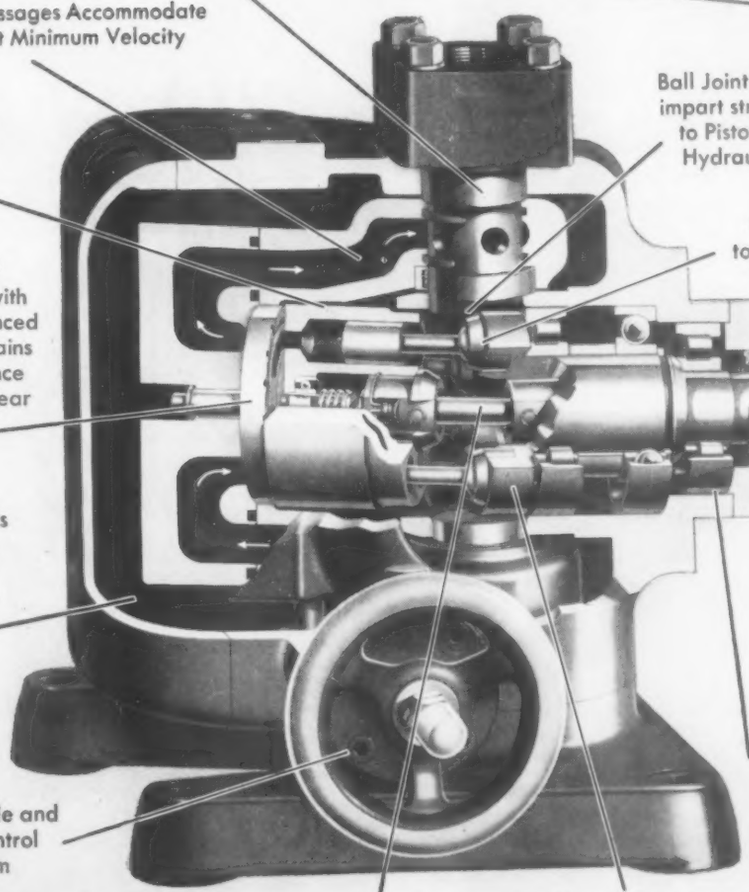
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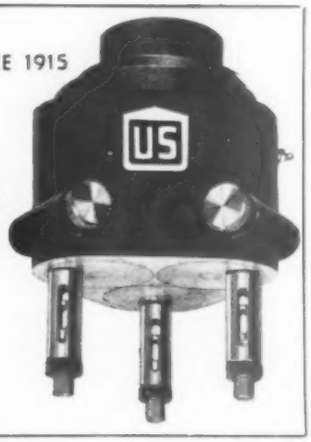

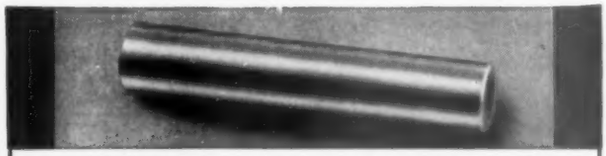

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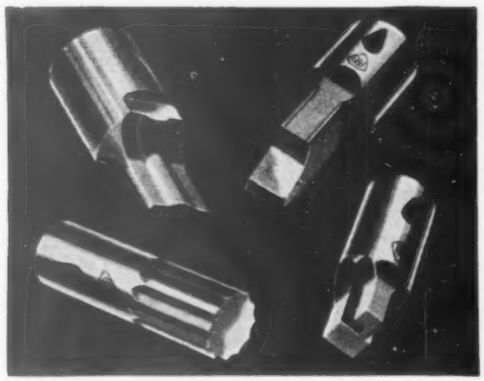

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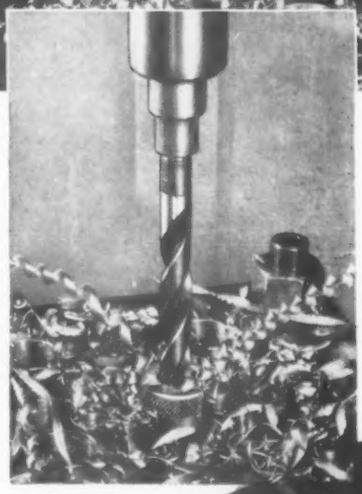
More Speed... LONGER DRILL LIFE WITH CONTINENTAL'S New DRILL CHIP BREAKER



Above: With the Continental Drill Chip Breaker, the chip is broken at regular intervals. Small loose chips are easily carried up the flutes. Holes are straighter, rounder, and have better wall finish.

Left: With conventional drilling, solid chips pack the drill flutes, causing scratched, out-of-round, and crooked holes. The drill must be withdrawn repeatedly to clear flutes and avoid drill breakage.

• Faster drilling action and prolonged tool life are but two of many advantages obtained with the Continental Drill Chip Breaker. By breaking chips into small, uniform pieces that are easily carried up the flutes of the drill, clogging is eliminated. The unit can be used vertically, horizontally, or at any angle as long as the housing can be kept stationary while the drill rotates. The arm prevents rotation of the housing. Where space permits, the Continental Drill Chip Breaker can be used in multiple spindle heads. *Write for Continental Bulletin 28161 today for sizes and complete specifications.*

YOU PROFIT 7 WAYS WITH CONTINENTAL'S DRILL CHIP BREAKER

1. GREATER SPEED—Because there is no clogging, it is not necessary to withdraw the drill to clear chips from the hole.
2. PROLONGED TOOL LIFE—The free cutting action results in more holes being drilled before sharpening is necessary.
3. BETTER FINISH ON HOLES—Holes are round, straight, and smooth. The short chips travel up the drill flutes without scratching or clogging.
4. DEEPER HOLES—It is possible to drill holes many diameters deeper, eliminating the necessity of withdrawing the drill from hole to relieve chips.
5. AUTOMATIC FEED—Automatic feed can be used without the danger of drill breakage that so often results from chip-clogged holes.
6. GREATER SAFETY—There are no long, whirling, spiral chips to burn hands or cut fingers.
7. CLEANER OPERATION—Coolant penetrates easily to the very point of the drill; the short chips do not splash it on machine or operator.

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TRADE MARK

COMPLETELY COLD FORGED

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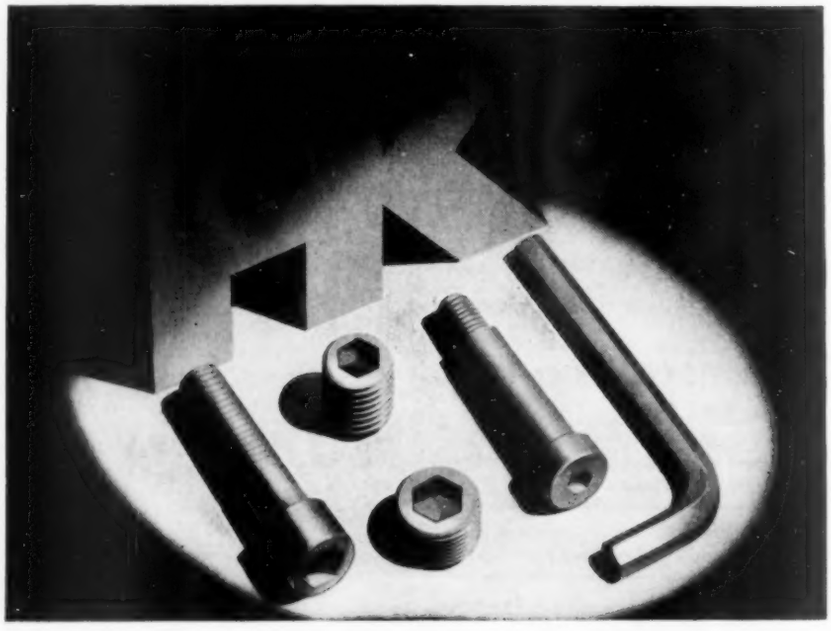

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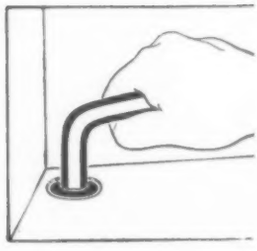

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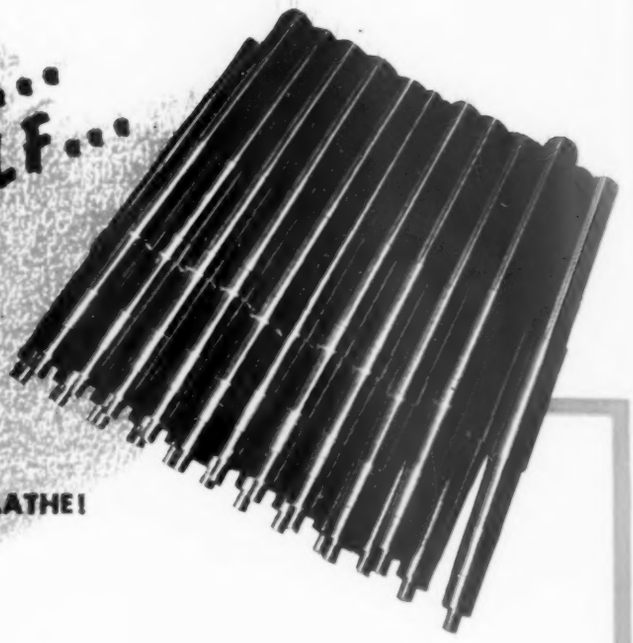

OPERATION: Cutting taper, relief, and thread ... smooth finish overall ... on chrome moly (#4130) steel laundry extractor spindles in the plant of WESTERN LAUNDRY MACHINERY CO., North Kansas City, Mo.

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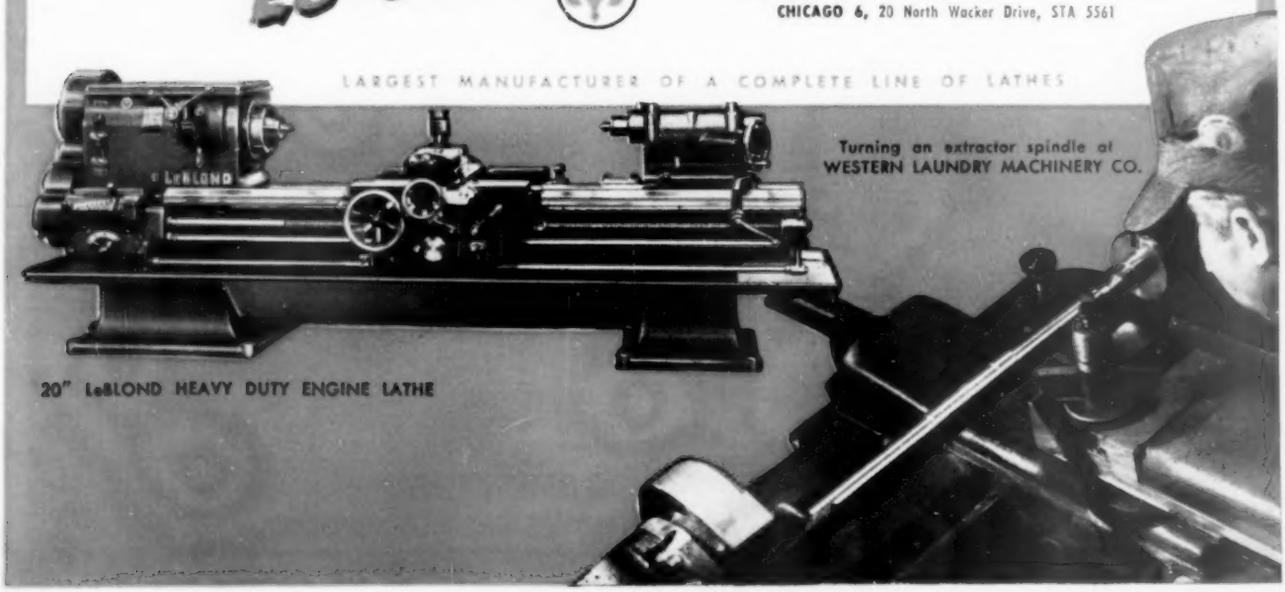

20" LeBLOND HEAVY DUTY ENGINE LATHE

Turning an extractor spindle at WESTERN LAUNDRY MACHINERY CO.